FCC PART 15.247
RSS-247, ISSUE 2, FEBRUARY 2017
RSS-GEN, ISSUE 5,FEBRUARY 2021AMENDMENT 2

TEST REPORT

For

Anker Innovations Limited

Room 1318-19,Hollywood Plaza,610 Nathan Road,Mongkok,Kowloon,Hong Kong

FCC ID:2AOKB-T8213
IC: 23451-T8213

Report Type:	**Product Name:**
Original Report	eufy Security Video Doorbell Dual(Battery)

Report Number: DG2210819-35223E-00A

Report Date: 2021-10-25

Candy Li

Reviewed By: RF Engineer

Prepared By: Shenzhen Accurate Technology Co., Ltd.
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Note: This report may contain data that are not covered by the A2LA accreditation and are marked with an asterisk "★".

Shenzhen Accurate Technology Co., Ltd. is not responsible for the authenticity of any test data provided by the applicant. Data included from the applicant that may affect test results are marked with an asterisk '*'. Customer model name, addresses, names, trademarks etc. are not considered data.

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DOCUMENT REVISION HISTORY

Revision Number	Report Number	Description of Revision	Date of Revision
0	DG2210819-35223E-00A	/	2020-09-27
1	DG2210819-35223E-00A	Updated MPE	2021-10-25

GENERAL INFORMATION

Product Description for Equipment under Test (EUT)

Product	eufy Security Video Doorbell Dual(Battery)
Trademark	eufy SECURITY
Tested Model	T8213
Frequency Range	2412-2462MHz
Maximum Conducted Peak Output Power	22.86 dBm
Modulation Technique	DSSS, OFDM
Antenna Specification*	2 dBi
Voltage Range	DC 3.63V from battery or DC 5V from adapter or DC 8-24V from Door Bell System
Date of Test	2021-08-24 to 2021-09-25
Sample serial number	DG2210819-35223E-RF-S1
Received date	2021.08.20
Sample/EUT Status	Good condition

Note: Per 15B emission test, the worst is DC 5V power input mode, so this mode was tested for this report.

Objective

This report is prepared on behalf in accordance with Part 2, Subpart J, Part 15, Subparts A and C of the Federal Communications Commission's rules. RSS-247, Issue 2, February 2017, RSS-Gen Issue 5, February 2021 Amendment 2 of the Innovation, Science and Economic Development Canada.

The tests were performed in order to determine the compliance of the EUT with FCC Rules Part 15-Subpart C, section 15.203, 15.205,15.207, 15.209 and 15.247 rules, RSS-247, Issue 2, February 2017, RSS-Gen Issue 5, February 2021 Amendment 2 of the Innovation, Science and Economic Development Canada.

Test Methodology

All measurements contained in this report were conducted with ANSI C63.10-2013, American National Standard of Procedures for Compliance Testing of Unlicensed Wireless Devices. And KDB 558074 D01 15.247 Meas Guidance v05r02, RSS-247, Issue 2, February 2017, RSS-Gen Issue 5, February 2021 Amendment 2 of the Innovation, Science and Economic Development Canada.

All emissions measurement was performed at Shenzhen Accurate Technology Co., Ltd. The radiated testing was performed at an antenna-to-EUT distance of 3 meters.

Measurement Uncertainty

Parameter		Uncertainty
Occupied Channel Bandwidth		5%
RF output power, conducted		0.73dB
Unwanted Emission, conducted		1.6dB
Emissions, Radiated	30MHz - 1GHz	4.28dB
	1GHz- 18GHz	4.98dB
	18GHz- 26.5GHz	5.06dB
Temperature		1℃
Humidity		6%
Supply voltages		0.4%

Note: The extended uncertainty given in this report is obtained by combining the standard uncertainty times the coverage factor K with the 95% confidence interval.Otherwise required by the applicant or Product Regulations, Decision Rule in this report did not consider the uncertainty.

Test Facility

The test site used by Shenzhen Accurate Technology Co., Ltd. to collect test data is located on the 1/F., Building A, Changyuan New Material Port, Science & Industry Park, Nanshan District, Shenzhen, Guangdong, P.R. China.

The test site has been approved by the FCC under the KDB 974614 D01 and is listed in the FCC Public Access Link (PAL) database, FCC Registration No.: 708358,the FCC Designation No.: CN1189. Accredited by American Association for Laboratory Accreditation (A2LA) The Certificate Number is 429 7.01.

Listed by Innovation, Science and Economic Development Canada (ISEDC), the Registration Number is 5077A.

SYSTEM TEST CONFIGURATION

Description of Test Configuration

For 802.11b, 802.11g, 802.11n-HT20 mode, total 11 channels are provided to testing:

Channel	Frequency (MHz)	Channel	Frequency (MHz)
1	2412	7	2442
2	2417	8	2447
3	2422	9	2452
4	2427	10	2457
5	2432	11	2462
6	2437	/	/

802.11b, 802.11g and 802.11n-HT20 modewas tested with Channel 1, 6 and 11.

Equipment Modifications

No modification was made to the EUT tested.

EUT Exercise Software

"SSCOM5.13.1" software was used to test, which provided by manufacturer and power level as below:

Mode	Channel	Frequency (MHz)	Data Rate	Power level Setting
802.11b	Low	2412	1 Mbps	0
	Middle	2437	1 Mbps	0
	High	2462	1 Mbps	-20
802.11g	Low	2412	6 Mbps	-80
	Middle	2437	6 Mbps	-70
	High	2462	6 Mbps	-70
802.11n ht20	Low	2412	MCS0	-90
	Middle	2437	MCS0	-80
	High	2462	MCS0	-70

Duty cycle

Test Result: Compliant. Please refer to the Appendix Wi-Fi.

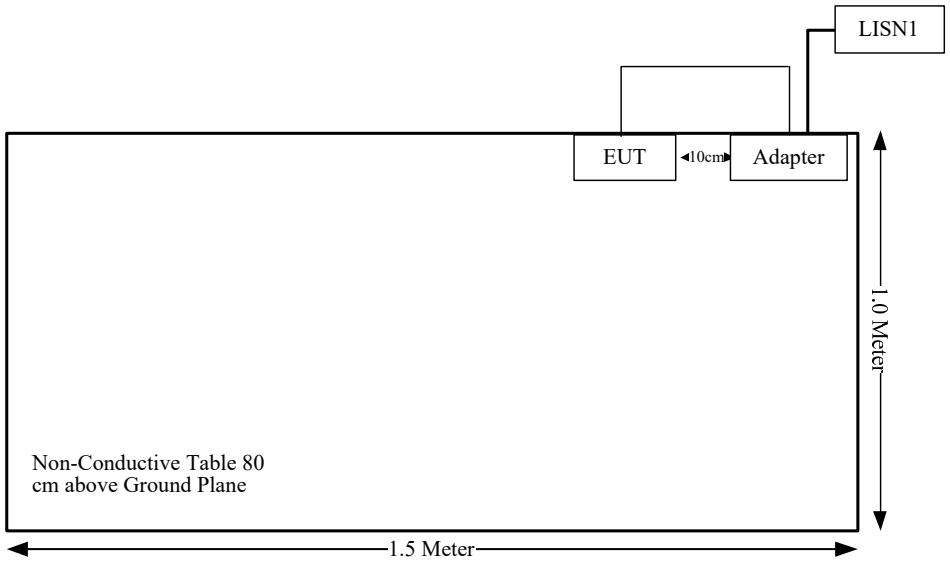
Support Equipment List and Details

Manufacturer	Description	Model	Serial Number
Hytera	Adapter	TAS-AN00	S010WU0500200

External I/O Cable

Cable Description	Shielding Type	Ferrite Core	Length (m)	From Port	To
Adapter Cable	No	No	0.5	Adapter	EUT

Block Diagram of Test Setup



SUMMARY OF TEST RESULTS

Rules	Description of Test	Result
§15.247 (i) & §1.1310 & §2.1091 RSS-102 Clause 4	Maximum Permissible Exposure (MPE)	Compliance
FCC §15.203, RSS-GEN Clause 6.8	Antenna Requirement	Compliance
FCC §15.207 (a); RSS-Gen Clause 8.8	AC Line Conducted Emissions	Compliance
FCC §15.205, §15.209, §15.247(d); RSS-247 Clause 5.5 RSS-Gen Clause 8.10	Spurious Emissions	Compliance
FCC §15.247 (a)(2); RSS-247 Clause 5.2 a) RSS-Gen Clause 6.7	6 dB Bandwidth and 99% Occupied Bandwidth	Compliance
FCC §15.247(b)(3); RSS-247 Clause 5.4 d)	Maximum Conducted Output Power	Compliance
FCC §15.247(d); RSS-247 Clause 5.5	100 kHz Bandwidth of Frequency Band Edge	Compliance
FCC §15.247(e) RSS-247 Clause 5.2 b)	Power Spectral Density	Compliance

TEST EQUIPMENT LIST

Manufacturer	Description	Model	Serial Number	Calibration Date	Calibration Due Date
Conducted Emissions Test					
Rohde& Schwarz	Test Receiver	ESPI3	100396	2020/12/24	2021/12/23
R & S	L.I.S.N.	ENV216	101314	2020/12/25	2021/12/24
Anritsu Corp	50Ω Coaxial Switch	MP59B	6200506474	2020/12/25	2021/12/24
Unknown	RF Coaxial Cable	N-2m	No.2	2020/12/25	2021/12/24
Radiated Emissions Test					
Rohde&Schwarz	Test Receiver	ESR	101817	2020/12/24	2021/12/23
Rohde & Schwarz	Spectrum Analyzer	FSV-40	101495	2020/12/24	2021/12/23
A.H. Systems, inc.	Preamplifier	PAM-0118P	531	2021/07/08	2022/07/07
SONOMA INSTRUMENT	Amplifier	310 N	186131	2020/12/25	2021/12/24
Schwarzbeck	HORN ANTENNA	BBHA9170	9170-359	2020/01/05	2023/01/04
Quinstar	Amplifier	QLW-18405536-J0	15964001002	2020/11/28	2021/11/27
Schwarzbeck	Bilog Antenna	VULB9163	9163-323	2020/01/04	2023/01/03
Schwarzbeck	Horn Antenna	BBHA9120D	9120D-1067	2020/01/05	2023/01/04
Unknown	RF Coaxial Cable	N-5m	No.3	2020/12/25	2021/12/24
Unknown	RF Coaxial Cable	N-5m	No.4	2020/12/25	2021/12/24
Unknown	RF Coaxial Cable	N-1m	No.5	2020/12/25	2021/12/24
Unknown	RF Coaxial Cable	N-1m	No.6	2020/12/25	2021/12/24
RF Conducted Test					
Rohde&Schwarz	Spectrum Analyzer	FSV40	101495	2020/12/24	2021/12/23
Rohde & Schwarz	Open Switch and Control Unit	OSP120 + OSP-B157	101244 + 100866	2020/12/24	2021/12/23

*** Statement of Traceability:** Shenzhen Accurate Technology Co., Ltd. attests that all calibrations have been performed in accordance to requirements that traceable to National Primary Standards and International System of Units (SI).

FCC §15.247 (i) & §1.1310 & §2.1091, RSS-102 CLAUSE 4- MAXIMUM PERMISSIBLE EXPOSURE (MPE)

Applicable Standard

According to subpart 15.247 (i) and subpart 2.1091 systems operating under the provisions of this section shall be operated in a manner that ensures the public is not exposed to RF energy level in excess of the communication guidelines.

Limits for General Population/Uncontrolled Exposure

Limits for General Population/Uncontrolled Exposure				
FrequencyRange (MHz)	**Electric Field Strength (V/m)**	**Magnetic Field Strength (A/m)**	**Power Density (mW/cm^2)**	**Averaging Time (Minutes)**
0.3-1.34	614	1.63	*(100)	30
1.34-30	824/f	2.19/f	*($180/f^2$)	30
30-300	27.5	0.073	0.2	30
300-1500	/	/	f/1500	30
1500-100,000	/	/	1.0	30

f = frequency in MHz
* = Plane-wave equivalent power density

According to RSS-102 § 4Table 4, RF Field Strength Limits for Devices Used by the General Public (Uncontrolled Environment)

Table 4: RF Field Strength Limits for Devices Used by the General Public (Uncontrolled Environment)

Frequency Range (MHz)	Electric Field (V/m rms)	Magnetic Field (A/m rms)	Power Density (W/m^2)	Reference Period (minutes)
$0.003\text{-}10^{21}$	83	90	-	Instantaneous*
0.1-10	-	$0.73/f$	-	6**
1.1-10	$87/f^{0.5}$	-	-	6**
10-20	27.46	0.0728	2	6
20-48	$58.07/f^{0.25}$	$0.1540/f^{0.25}$	$8.944/f^{0.5}$	6
48-300	22.06	0.05852	1.291	6
300-6000	$3.142f^{0.3417}$	$0.008335f^{0.3417}$	$0.02619f^{0.6834}$	6
6000-15000	61.4	0.163	10	6
15000-150000	61.4	0.163	10	$616000/f^{1.2}$
150000-300000	$0.158f^{0.5}$	$4.21 \times 10^{-4}f^{0.5}$	$6.67 \times 10^{-5}f$	$616000/f^{1.2}$

Note: f is frequency in MHz.
*Based on nerve stimulation (NS).
** Based on specific absorption rate (SAR).

Result

Calculated Formulary:

Predication of MPE limit at a given distance

$$S = \frac{PG}{4\pi R^2}$$

S = power density (in appropriate units, e.g. mW/cm^2)
P = power input to the antenna (in appropriate units, e.g., mW).
G = power gain of the antenna in the direction of interest relative to an isotropic radiator,the power gain factor, is normally numeric gain.
R = distance to the center of radiation of the antenna (appropriate units, e.g., cm)

For simultaneously transmit system, the calculated power density should comply with:

$$\sum_i \frac{S_i}{S_{Limit,i}} \le 1$$

Calculated Data:

Mode	Frequency (MHz)	Antenna Gain		Conducted output power including Tune-up Tolerance*		Evaluation Distance (cm)	Power Density		FCC MPE Limit (mW/cm^2)	ISED MPE Limit (W/m^2)
		(dBi)	(numeric)	(dBm)	(mW)		(mW/cm^2)	(W/m^2)		
WLAN	2412-2462	2	1.58	23	199.53	20.00	0.063	0.63	1.0	5.37
Radar	24054.99891 - 24242.99888	0	1.00	11	12.59	20.00	0.003	0.03	1.0	10

Note: The Tune up power was declared by manufacturer.

The WLAN and Radar can transmit simultaneously:

For FCC:

$$\sum_i \frac{S_i}{S_{Limit,i}}$$

$=S_{WLAN}/S_{limit-\ WLAN}+ S_{Radar}/S_{limit-Radar}$

=0.063/1+0.003/1

=0.066

< 1.0

Result: The device meet FCC MPE at 20 cm distance

For ISED:

$$\sum_i \frac{S_i}{S_{Limit,i}}$$

$=S_{WLAN}/S_{limit-\ WLAN}+ S_{Radar}/S_{limit-Radar}$

=0.63/5.37+0.03/10

=0.12

< 1.0

Result: The device meet MPE at 20 cm distance

FCC §15.203, RSS-GEN CLAUSE 6.8 - ANTENNA REQUIREMENT

Applicable Standard

According to § 15.203, an intentional radiator shall be designed to ensure that no antenna other than that furnished by the responsible party shall be used with the device. The use of a permanently attached antenna or of an antenna that uses a unique coupling to the intentional radiator shall be considered sufficient to comply with the provisions of this section. The manufacturer may design the unit so that a broken antenna can be replaced by the user, but the user of a standard antenna jack or electrical connector is prohibited. The structure and application of the EUT were analyzed to determine compliance with section §15.203 of the rules. §15.203 state that the subject device must meet the following criteria:

a. Antenna must be permanently attached to the unit.
b. Antenna must use a unique type of connector to attach to the EUT.

Unit must be professionally installed, and installer shall be responsible for verifying that the correct antenna is employed with the unit.
And according to FCC 47 CFR section 15.247 (b), if the transmitting antennas of directional gain greater than 6dBi are used, the power shall be reduced by the amount in dB that the directional gain of the antenna exceeds 6 dBi.

According to RSS-Gen §6.8, The applicant for equipment certification shall provide a list of all antenna types that may be used with the transmitter, where applicable (i.e. for transmitters with detachable antenna), indicating the maximum permissible antenna gain (in dBi) and the required impedance for each antenna. The test report shall demonstrate the compliance of the transmitter with the limit for maximum equivalent isotropically radiated power (e.i.r.p.) specified in the applicable RSS, when the transmitter is equipped with any antenna type, selected from this list.
For expediting the testing, measurements may be performed using only the antenna with highest gain of each combination of transmitter and antenna type, with the transmitter output power set at the maximum level. However, the transmitter shall comply with the applicable requirements under all operational conditions and when in combination with any type of antenna from the list provided in the test report (and in the notice to be included in the user manual, provided below).
When measurements at the antenna port are used to determine the RF output power, the effective gain of the device's antenna shall be stated, based on a measurement or on data from the antenna's manufacturer.
The test report shall state the RF power, output power setting and spurious emission measurements with each antenna type that is used with the transmitter being tested.
For licence-exempt equipment with detachable antennas, the user manual shall also contain the following notice in a conspicuous location:

This radio transmitter [enter the device's ISED certification number] has been approved by Innovation, Science and Economic Development Canada to operate with the antenna types listed below, with the maximum permissible gain indicated. Antenna types not included in this list that have a gain greater than the maximum gain indicated for any type listed are strictly prohibited for use with this device.

Immediately following the above notice, the manufacturer shall provide a list of all antenna types which can be used with the transmitter, indicating the maximum permissible antenna gain (in dBi) and the required impedance for each antenna type.

Antenna Connector Construction

The EUT has one internal FPC antenna permanently attached to the unit for Wi-Fi, fulfill the requirement of this section. The antenna gain is 2.0 dBi. Please refer to the EUT photos.

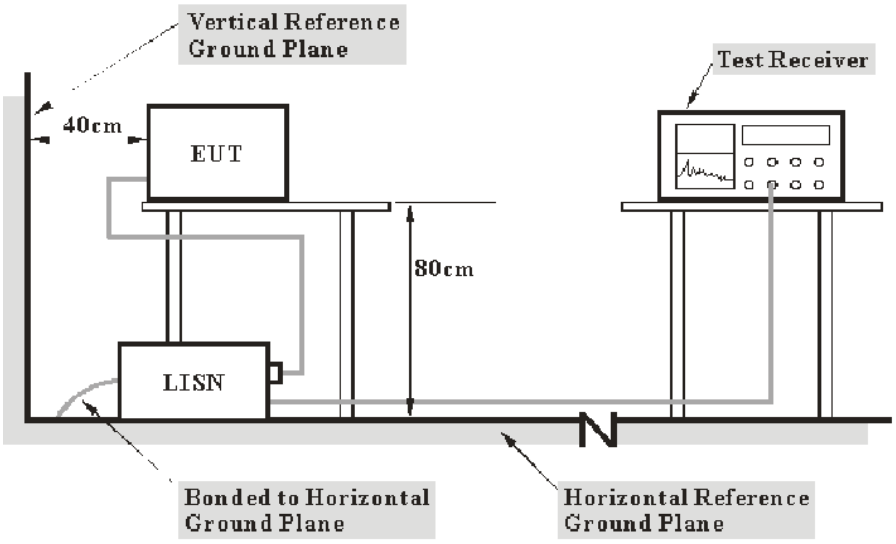
Result: Compliance.

FCC §15.207 (a), RSS-GEN CLAUSE 8.8 – AC LINE CONDUCTED EMISSIONS

Applicable Standard

FCC§15.207(a). RSS-Gen§8.8.

EUT Setup



Note: 1. Support units were connected to second LISN.
2. Both of LISNs (AMN) 80 cm from EUT and at the least 80 cm from other units and other metal planes support units.

The setup of EUT is according with per ANSI C63.10-2013 measurement procedure. The specification used was with the FCC Part 15.207 limits and RSS-Gen limits.

The spacing between the peripherals was 10 cm.

EMI Test Receiver Setup

The EMI test receiver was set to investigate the spectrum from 150 kHz to 30MHz.

During the conducted emission test, the EMI test receiver was set with the following configurations:

FrequencyRange	IF B/W
150 kHz – 30 MHz	9 kHz

Test Procedure

During the conducted emission test, the adapter was connected to the outlet of the LISN.

Maximizing procedure was performed on the six (6) highest emissions of the EUT.

All final data was recorded in the Quasi-peak and average detection mode.

Transd Factor & Margin Calculation

The Transd factor is calculated by adding LISN VDF (Voltage Division Factor), Cable Loss and Transient Limiter Attenuation. The basic equation is as follows:

TransdFactor = LISN VDF + Cable Loss

The "**Margin**" column of the following data tables indicates the degree of compliance with the applicable limit. For example, a margin of 7dB means the emission is 7 dB below the limit. The equation for margin calculation is as follows:

Margin = Limit – level
Level= reading level+TransdFactor

Test Data

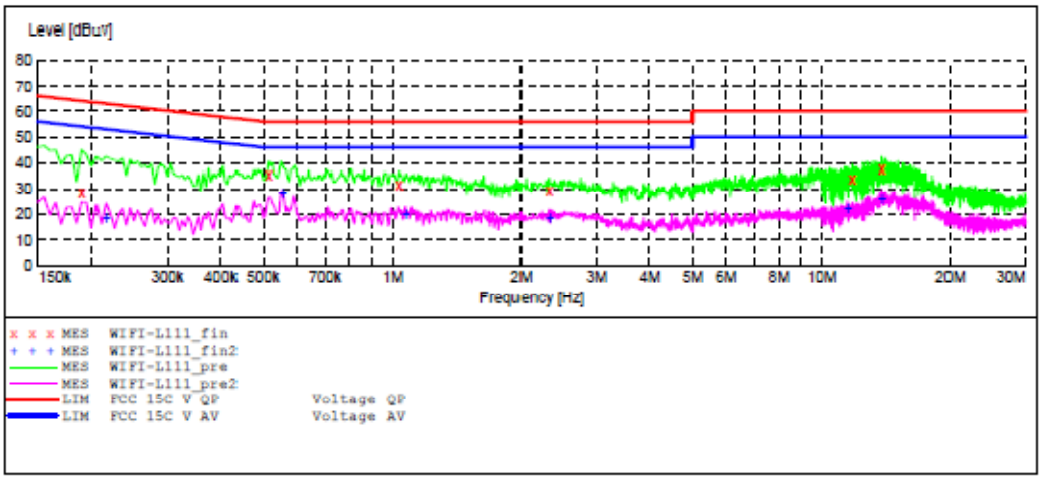
Environmental Conditions

Temperature:	26.2℃
Relative Humidity:	63%
ATM Pressure:	100.3kPa
Tester:	*Fan Yang*
Test Date:	2021-09-12

EUT operation mode: Transmitting (Worst case as below)

Wi-Fi: 802.11B mode, low Channel

AC 120V/60 Hz, Line



MEASUREMENT RESULT: "WIFI-L111_fin"

2021-9-12 11:36

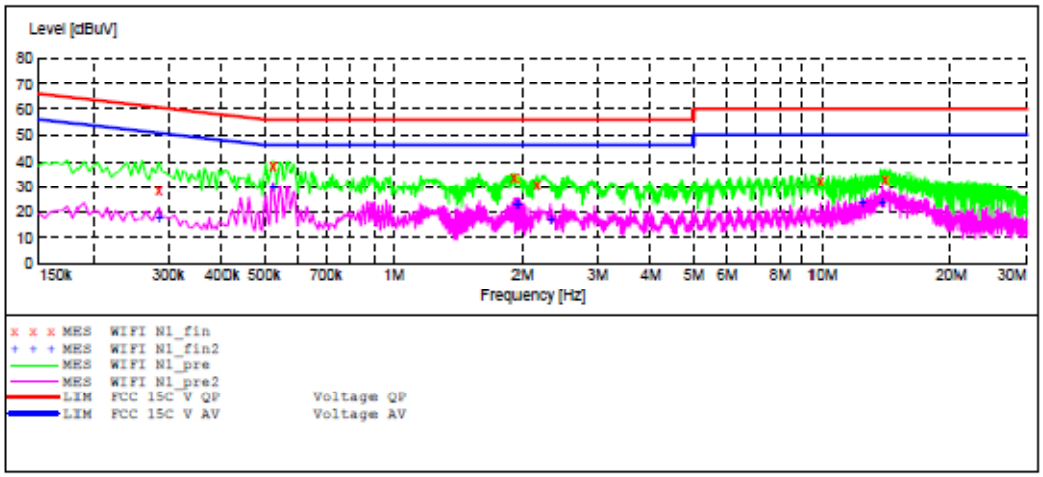
Frequency MHz	Level dBuV	Transd dB	Limit dBuV	Margin dB	Detector	Line	PE
0.190000	28.60	10.8	64	35.4	QP	L1	GND
0.515000	35.50	11.0	56	20.5	QP	L1	GND
1.035000	32.00	11.1	56	24.0	QP	L1	GND
2.320000	29.30	11.3	56	26.7	QP	L1	GND
11.775000	33.80	11.6	60	26.2	QP	L1	GND
13.825000	37.50	11.6	60	22.5	QP	L1	GND

MEASUREMENT RESULT: "WIFI-L111_fin2"

2021-9-12 11:36

Frequency MHz	Level dBuV	Transd dB	Limit dBuV	Margin dB	Detector	Line	PE
0.215000	18.60	10.8	53	34.4	AV	L1	GND
0.555000	28.90	11.0	46	17.1	AV	L1	GND
1.070000	20.40	11.1	46	25.6	AV	L1	GND
2.320000	19.10	11.3	46	26.9	AV	L1	GND
11.500000	22.20	11.6	50	27.8	AV	L1	GND
13.825000	26.50	11.6	50	23.5	AV	L1	GND

AC 120V/60 Hz, Neutral



MEASUREMENT RESULT: "WIFI N1_fin"

2021-9-12 11:52

Frequency MHz	Level dBuV	Transd dB	Limit dBuV	Margin dB	Detector	Line	PE
0.285000	28.90	10.9	61	32.1	QP	N	GND
0.525000	38.40	11.0	56	17.6	QP	N	GND
1.925000	33.80	11.3	56	22.2	QP	N	GND
2.160000	30.60	11.3	56	25.4	QP	N	GND
9.860000	32.10	11.6	60	27.9	QP	N	GND
14.025000	33.20	11.6	60	26.8	QP	N	GND

MEASUREMENT RESULT: "WIFI N1_fin2"

2021-9-12 11:52

Frequency MHz	Level dBuV	Transd dB	Limit dBuV	Margin dB	Detector	Line	PE
0.285000	18.30	10.9	51	32.7	AV	N	GND
0.525000	30.10	11.0	46	15.9	AV	N	GND
1.945000	23.30	11.3	46	22.7	AV	N	GND
2.320000	17.30	11.3	46	28.7	AV	N	GND
12.375000	24.30	11.6	50	25.7	AV	N	GND
13.800000	24.20	11.6	50	25.8	AV	N	GND

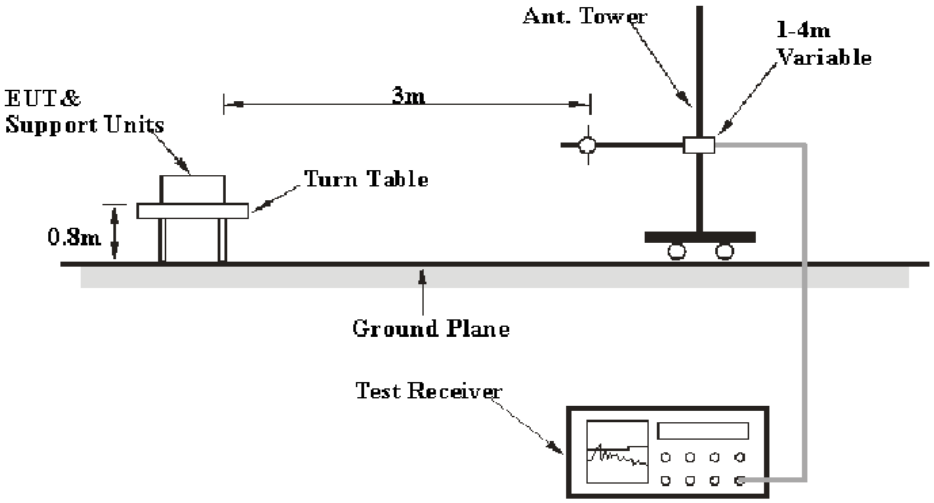
FCC §15.209, §15.205 & §15.247(d), RSS-247 CLAUSE 5.5, RSS-GEN CLAUSE 8.10 - SPURIOUS EMISSIONS

Applicable Standard

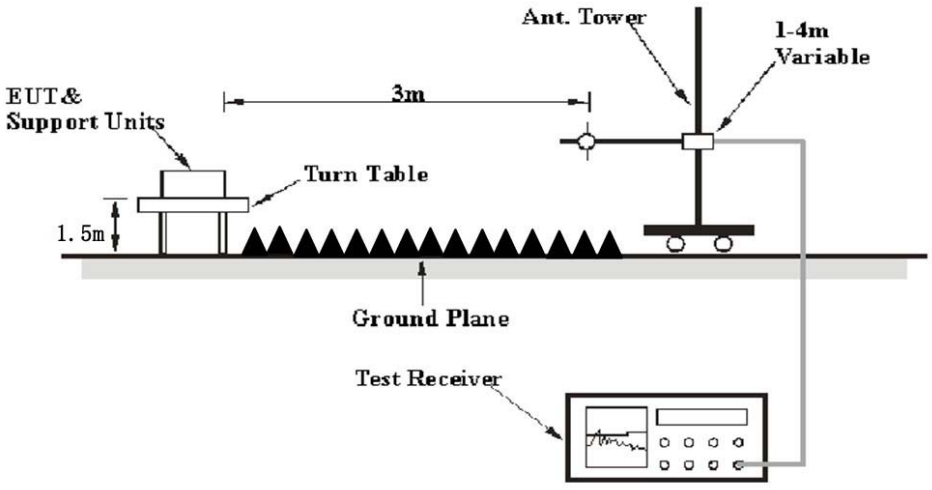
FCC §15.247 (d); §15.209; §15.205; RSS-247 §5.5, RSS-GEN §8.10.

EUT Setup

Below 1 GHz:



Above 1GHz:



The radiated emission tests were performed in the 3meters test site, using the setup accordance with the ANSI C63.10-2013. The specification used was the FCC 15.209, and FCC 15.247 limits.

EMI Test Receiver & Spectrum Analyzer Setup

During the radiated emission test, the EMI test receiver & Spectrum Analyzer Setup were set with the following configurations:

Frequency Range	RBW	Video B/W	IF B/W	Measurement
30MHz – 1000 MHz	100 kHz	300 kHz	120kHz	QP
Above 1 GHz	1MHz	3 MHz	/	PK
	1MHz	10 Hz Note 1	/	Average
	1MHz	＞1/T Note 2	/	Average

Note 1: when duty cycle is no less than 98%
Note 2: when duty cycle is less than 98%

Test Procedure

Maximizing procedure was performed on the highest emissions to ensure that the EUT complied with all installation combinations.

Data was recorded in Quasi-peak detection mode for frequency range of 30 MHz-1 GHz, peak and Average detection modes for frequencies above 1 GHz.

Factor& Margin Calculation

The Factor is calculated by adding the Antenna Factor and Cable Loss, and subtracting the Amplifier Gain from the MeterReading. The basic equation is as follows:

Factor = Meter Reading + Antenna Factor + Cable Loss - Amplifier Gain

The "**Margin**" column of the following data tables indicates the degree of compliance with the applicable limit. For example, a margin of -7dB means the emission is 7dB below the limit. The equation for margin calculation is as follows:

Margin = Result-Limit
Result = Reading + Factor

Test Data

Environmental Conditions

Temperature:	28.6 ℃
Relative Humidity:	58 %
ATM Pressure:	100.8kPa

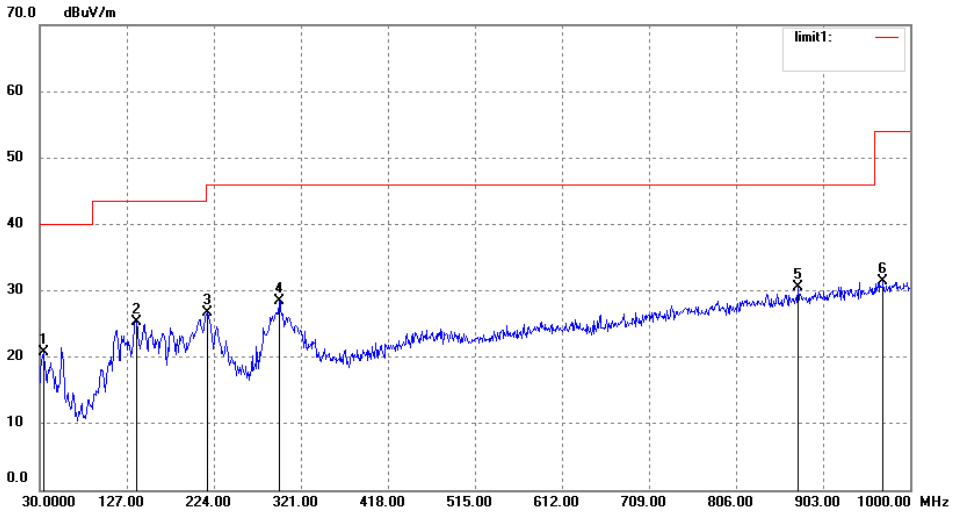
The testing was performed by Fan Yangon 2021-09-25.

EUT operation mode: Transmitting

30MHz-1GHz: (Worst case)

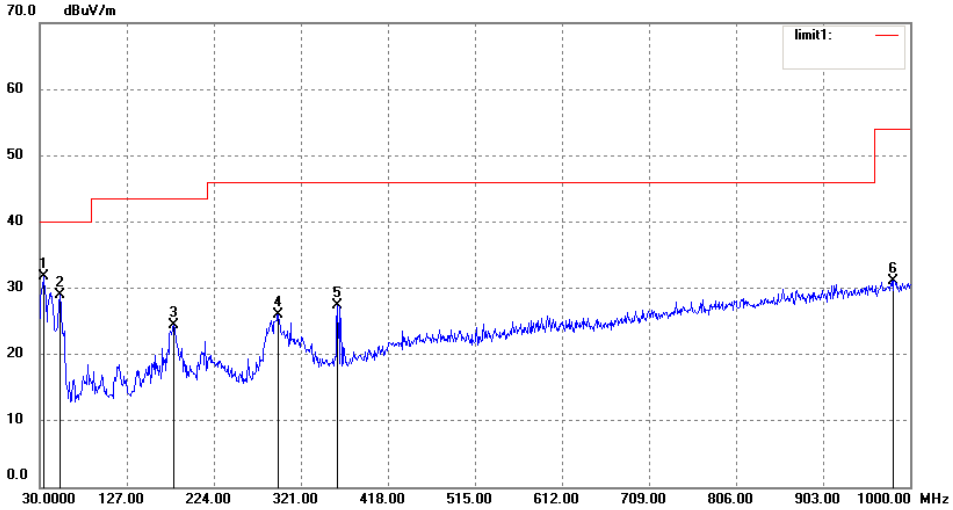
Wi-Fi: 802.11B mode, Low Channel

Horizontal



No.	Frequency (MHz)	Reading (dBuV/m)	Correct Factor(dB)	Result (dBuV/m)	Limit (dBuV/m)	Margin (dB)	Detector
1	33.8800	40.65	-19.97	20.68	40.00	-19.32	peak
2	137.6700	44.86	-19.61	25.25	43.50	-18.25	peak
3	217.2100	43.92	-17.15	26.77	46.00	-19.23	peak
4	296.7500	43.09	-14.61	28.48	46.00	-17.52	peak
5	874.8700	34.54	-3.96	30.58	46.00	-15.42	peak
6	969.9300	34.01	-2.53	31.48	54.00	-22.52	peak

Vertical



No.	Frequency (MHz)	Reading (dBuV/m)	Correct Factor(dB)	Result (dBuV/m)	Limit (dBuV/m)	Margin (dB)	Detector
1	33.8800	51.78	-19.97	31.81	40.00	-8.19	peak
2	52.3100	46.12	-17.24	28.88	40.00	-11.12	peak
3	179.3799	43.01	-18.56	24.45	43.50	-19.05	peak
4	295.7799	40.71	-14.64	26.07	46.00	-19.93	peak
5	361.7400	40.58	-13.15	27.43	46.00	-18.57	peak
6	981.5700	33.40	-2.27	31.13	54.00	-22.87	peak

1-25 GHz:

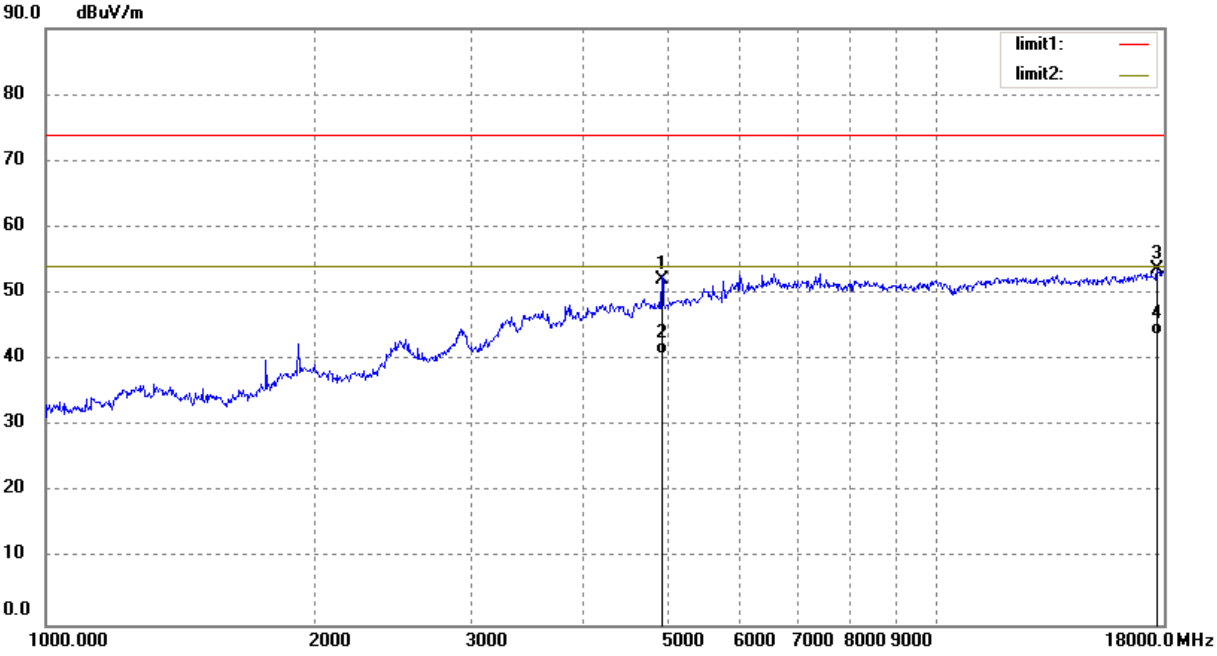
Frequency (MHz)	Receiver		Turntable Angle Degree	Rx Antenna		Factor (dB/m)	Absolute Level (dBuV/m)	Limit (dBuV/m)	Margin (dB)
	Reading (dBuV)	PK/Ave		Height (m)	Polar (H/V)				
802.11B, Low Channel									
2390	61.98	PK	163	1.8	V	-6.44	55.54	74	18.46
2390	56.12	AVG	163	1.8	V	-6.44	49.68	54	4.32
4824	52.35	PK	18	1.4	V	2.87	55.22	74	18.78
4824	48.11	AVG	18	1.4	V	2.87	50.98	54	3.02
4824	49.56	PK	79	2.1	H	2.87	52.43	74	21.57
802.11B, Middle Channel									
4874	51.28	PK	143	1.4	V	3.01	54.29	74	19.71
4874	47.49	AVG	143	1.4	V	3.01	50.5	54	3.5
4874	49.33	PK	64	1.7	H	3.01	52.34	74	21.66
802.11B, High Channel									
2483.5	70.92	PK	184	1.9	V	-5.96	64.96	74	9.04
2483.5	56.53	AVG	184	1.9	V	-5.96	50.57	54	3.43
4924	50.62	PK	200	1.1	V	3.17	53.79	74	20.21
4924	46.95	AVG	200	1.1	V	3.17	50.12	54	3.88
4924	45.51	PK	206	1.7	H	3.17	48.68	74	25.32
802.11G, Low Channel									
2390	73.84	PK	69	2.2	V	-6.44	67.4	74	6.6
2390	57.79	AVG	69	2.2	V	-6.44	51.35	54	2.65
4824	49.34	PK	256	1.8	V	2.87	52.21	74	21.79
4824	38.4	AVG	256	1.8	V	2.87	41.27	54	12.73
4824	45.43	PK	161	2.1	H	2.87	48.3	74	25.7
802.11G, Middle Channel									
4874	48.59	PK	165	2.0	V	3.01	51.6	74	22.4
4874	37.07	AVG	165	2.0	V	3.01	40.08	54	13.92
4874	42.7	PK	165	2.0	H	3.01	45.71	74	28.29
802.11G, High Channel									
2483.5	78.32	PK	342	1.7	V	-5.96	72.36	74	1.64
2483.5	59.24	AVG	342	1.7	V	-5.96	53.28	54	0.72
4924	48.99	PK	194	1.2	V	3.17	52.16	74	21.84
4924	37.59	AVG	194	1.2	V	3.17	40.76	54	13.24
4924	45.38	PK	29	2.1	H	3.17	48.55	74	25.45
802.11N20, Low Channel									
2390	74.97	PK	57	1.0	V	-6.44	68.53	74	5.47
2390	57.67	AVG	57	1.0	V	-6.44	51.23	54	2.77
4824	49.22	PK	290	1.3	V	2.87	52.09	74	21.91
4824	37.48	AVG	290	1.3	V	2.87	40.35	54	13.65
4824	45.35	PK	129	2.0	H	2.87	48.22	74	25.78
802.11N20, Middle Channel									
4874	49.28	PK	231	2.2	V	3.01	52.29	74	21.71
4874	37.79	AVG	231	2.2	V	3.01	40.8	54	13.2
4874	45.12	PK	52	2.0	H	3.01	48.13	74	25.87

802.11N20, High Channel									
2483.5	76.17	PK	224	1.7	V	-5.96	70.21	74	3.79
2483.5	56.68	AVG	224	1.7	V	-5.96	50.72	54	3.28
4924	49.42	PK	78	1.1	V	3.17	52.59	74	21.41
4924	40.03	AVG	78	1.1	V	3.17	43.2	54	10.8
4924	45.13	PK	27	2.1	H	3.17	48.3	74	25.7

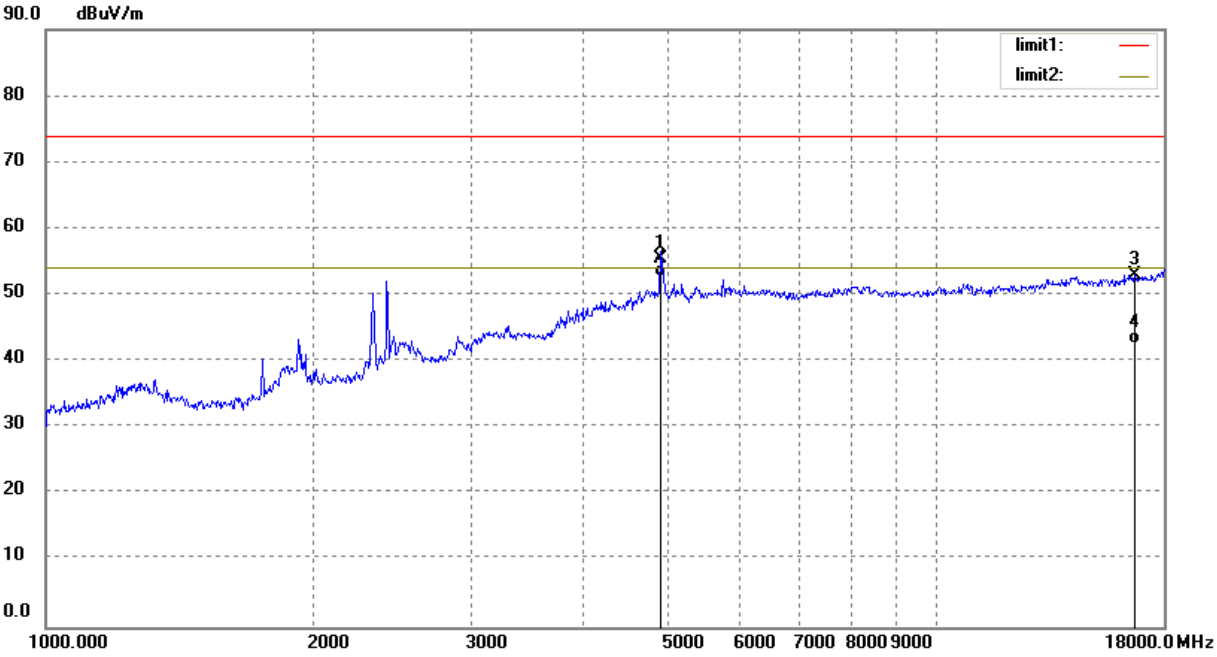
Note:
Corrected Factor=Antenna factor (RX) + Cable Loss – Amplifier Factor
Corrected Amplitude = Corrected Factor + Reading
Margin = Limit- Corrected. Amplitude
The other spurious emission which is 20dB to the limit was not recorded.
The test result of peak was less than the limit of average, so just peak values were recorded.

1-18 GHz:

Pre-scan for Peak
802.11b mode low Channel
Horizontal



Vertical



FCC §15.247(a) (2), RSS-GEN CLAUSE 6.7–6 dB EMISSION BANDWIDTH AND 99% OCCUPIED BANDWIDTH

Applicable Standard

According to FCC §15.247(a) (2)
Systems using digital modulation techniques may operate in the 902–928 MHz, 2400–2483.5 MHz, and 5725–5850 MHz bands. The minimum 6 dB bandwidth shall be at least 500 kHz.

According to RSS-247 §5.2 a)
The minimum 6 dB bandwidth shall be 500 kHz.

According to RSS-Gen §6.7
The occupied bandwidth or the "99% emission bandwidth" is defined as the frequency range between two points, one above and the other below the carrier frequency, within which 99% of the total transmitted power of the fundamental transmitted emission is contained. The occupied bandwidth shall be reported for all equipment in addition to the specified bandwidth required in the applicable RSSs.
In some cases, the "x dB bandwidth" is required, which is defined as the frequency range between two points, one at the lowest frequency below and one at the highest frequency above the carrier frequency, at which the maximum power level of the transmitted emission is attenuated x dB below the maximum in-band power level of the modulated signal, where the two points are on the outskirts of the in-band emission.
The following conditions shall be observed for measuring the occupied bandwidth and x dB bandwidth:

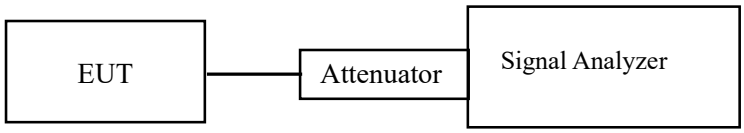
- The transmitter shall be operated at its maximum carrier power measured under normal test conditions.
- The span of the spectrum analyzer shall be set large enough to capture all products of the modulation process, including the emission skirts, around the carrier frequency, but small enough to avoid having other emissions (e.g. on adjacent channels) within the span.
- The detector of the spectrum analyzer shall be set to "Sample". However, a peak, or peak hold, may be used in place of the sampling detector since this usually produces a wider bandwidth than the actual bandwidth (worst-case measurement). Use of a peak hold (or "Max Hold") may be necessary to determine the occupied / x dB bandwidth if the device is not transmitting continuously.
- The resolution bandwidth (RBW) shall be in the range of 1% to 5% of the actual occupied / x dB bandwidth and the video bandwidth (VBW) shall not be smaller than three times the RBW value. Video averaging is not permitted.

Note: It may be necessary to repeat the measurement a few times until the RBW and VBW are in compliance with the above requirement.
For the 99% emission bandwidth, the trace data points are recovered and directly summed in linear power level terms. The recovered amplitude data points, beginning at the lowest frequency, are placed in a running sum until 0.5% of the total is reached, and that frequency recorded. The process is repeated for the highest frequency data points (starting at the highest frequency, at the right side of the span, and going down in frequency). This frequency is then recorded. The difference between the two recorded frequencies is the occupied bandwidth (or the 99% emission bandwidth).

Test Procedure

1. Check the calibration of the measuring instrument using either an internal calibrator or a known signal from an external generator.
2. Position the EUT without connection to measurement instrument. Turn on the EUT and connect it to measurement instrument. Then set it to any one convenient frequency within its operating range. Set a reference level on the measuring instrument equal to the highest peak value.
3. Measure the frequency difference of two frequencies that were attenuated 6 dB from the reference level. Record the frequency difference as the emission bandwidth.
4. Repeat above procedures until all frequencies measured were complete.

99% Occupied bandwidth test:
Use Occupied bandwidth test function, measure the 99% Occupied bandwidth.
Repeat above procedures until all frequencies measured were complete.



Test Data

Environmental Conditions

Temperature:	27 °C
Relative Humidity:	66%
ATM Pressure:	100.1 kPa

The testing was performed by Fan Yangon 2021-08-24.

EUT operation mode: Transmitting

Test Result: Compliant. Please refer to the Appendix Wi-Fi.

FCC §15.247(b) (3), RSS-247 CLAUSE 5.4 d) - MAXIMUM PEAK CONDUCTED OUTPUT POWER

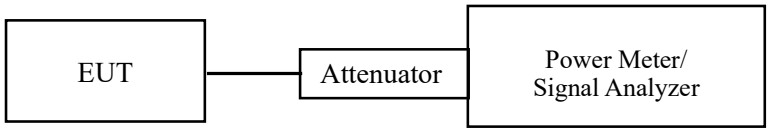
Applicable Standard

According to FCC §15.247(b) (3), for systems using digital modulation in the 902-928 MHz, 2400-2483.5 MHz, and 5725-5850 MHz bands: 1 Watt. As an alternative to a peak power measurement, compliance with the one Watt limit can be based on a measurement of the maximum conducted output power. Maximum Conducted Output Power is defined as the total transmit power delivered to all antennas and antenna elements averaged across all symbols in the signaling alphabet when the transmitter is operating at its maximum power control level. Power must be summed across all antennas and antenna elements. The average must not include any time intervals during which the transmitter is off or is transmitting at a reduced power level. If multiple modes of operation are possible (e.g., alternative modulation methods), the maximum conducted output power is the highest total transmit power occurring in any mode.

According to RSS-247§5.4 d) For DTSs employing digital modulation techniques operating in the bands 902-928 MHz and 2400-2483.5 MHz, the maximum peak conducted output power shall not exceed 1W. Except as provided in Section 5.4(e), the e.i.r.p. shall not exceed 4 W.
As an alternative to a peak power measurement, compliance can be based on a measurement of the maximum conducted output power. The maximum conducted output power is the total transmit power delivered to all antennas and antenna elements, averaged across all symbols in the signalling alphabet when the transmitter is operating at its maximum power control level. Power must be summed across all antennas and antenna elements. The average must not include any time intervals during which the transmitter is off or transmitting at a reduced power level. If multiple modes of operation are implemented, the maximum conducted output power is the highest total transmit power occurring in any mode.

Test Procedure

1. Place the EUT on a bench and set it in transmitting mode.
2. Remove the antenna from the EUT and then connect a low loss RF cable from the antenna port to one test equipment.
3. Add a correction factor to the display.



Test Data

Environmental Conditions

Temperature:	27 °C
Relative Humidity:	66%
ATM Pressure:	100.1 kPa

The testing was performed by Fan Yang on 2021-08-24.

EUT operation mode: Transmitting
Test Result: Compliant. Please refer to the Appendix Wi-Fi .

FCC §15.247(d), RSS-247 CLAUSE 5.5– 100 kHz BANDWIDTH OF FREQUENCY BAND EDGE

Applicable Standard

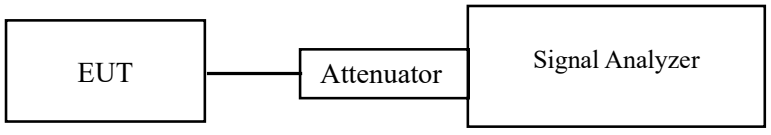
According to FCC§15.247(d):In any 100 kHz bandwidth outside the frequency band in which the spread spectrum or digitally modulated intentional radiator is operating, the radio frequency power that is produced by the intentional radiator shall be at least 20 dB below that in the 100 kHz bandwidth within the band that contains the highest level of the desired power, based on either an RF conducted or a radiated measurement, provided the transmitter demonstrates compliance with the peak conducted power limits. If the transmitter complies with the conducted power limits based on the use of RMS averaging over a time interval, as permitted under paragraph (b)(3) of this section, the attenuation required under this paragraph shall be 30 dB instead of 20 dB. Attenuation below the general limits specified in §15.209(a) is not required. In addition, radiated emissions which fall in the restricted bands, as defined in §15.205(a), must also comply with the radiated emission limits specified in §15.209(a) (see §15.205(c)).

According to RSS-247 Clause 5.5:

In any 100 kHz bandwidth outside the frequency band in which the spread spectrum or digitally modulated device is operating, the RF power that is produced shall be at least 20 dB below that in the 100 kHz bandwidth within the band that contains the highest level of the desired power, based on either an RF conducted or a radiated measurement, provided that the transmitter demonstrates compliance with the peak conducted power limits. If the transmitter complies with the conducted power limits based on the use of root-mean-square averaging over a time interval, as permitted under section 5.4(d), the attenuation required shall be 30 dB instead of 20 dB. Attenuation below the general field strength limits specified in RSS-Gen is not required.

Test Procedure

1. Check the calibration of the measuring instrument using either an internal calibrator or a known signal from an external generator.
2. Position the EUT without connection to measurement instrument. Turn on the EUT and connect its antenna terminal to measurement instrument via a low loss cable. Then set it to any one measured frequency within its operating range, and make sure the instrument is operated in its linear range.
3. Set RBW to 100 kHz and VBW of spectrum analyzer to 300 kHz with a convenient frequency span including 100 kHz bandwidth from band edge.
4. Measure the highest amplitude appearing on spectral display and set it as a reference level. Plot the graph with marking the highest point and edge frequency.
5. Repeat above procedures until all measured frequencies were complete.



Test Data

Environmental Conditions

Temperature:	27 °C
Relative Humidity:	66%
ATM Pressure:	100.1 kPa

The testing was performed by Fan Yang on 2021-08-24.

EUT operation mode: Transmitting

Test Result: Compliant.

Conducted Band Edge Result:

Please refer to the Appendix Wi-Fi.

FCC §15.247(e), RSS-247 CLAUSE 5.2 b) - POWER SPECTRAL DENSITY

Applicable Standard

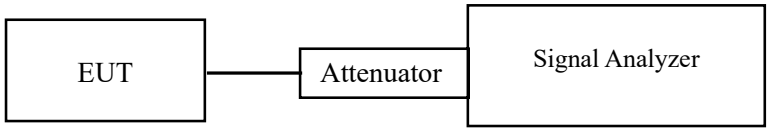
According to FCC §15.247(e):
For digitally modulated systems, the power spectral density conducted from the intentional radiator to the antenna shall not be greater than 8 dBm in any 3 kHz band during any time interval of continuous transmission. This power spectral density shall be determined in accordance with the provisions of paragraph (b) of this section. The same method of determining the conducted output power shall be used to determine the power spectral density.

According to RSS-247 §5.2 b):

b) The transmitter power spectral density conducted from the transmitter to the antenna shall not be greater than 8 dBm in any 3 kHz band during any time interval of continuous transmission. This power spectral density shall be determined in accordance with the provisions of section 5.4(d), (i.e. the power spectral density shall be determined using the same method as is used to determine the conducted output power).

Test Procedure

1. Use this procedure when the maximum peak conducted output power in the fundamental emission is used to demonstrate compliance.
2. Set the RBW to: 3kHz≤ RBW≤100 kHz.
3. Set the VBW ≥ 3×RBW.
4. Set the span to 1.5 times the DTS bandwidth.
5. Detector = peak.
6. Sweep time = auto couple.
7. Trace mode = max hold.
8. Allow trace to fully stabilize.
9. Use the peak marker function to determine the maximum amplitude level within the RBW.
10. If measured value exceeds limit, reduce RBW (no less than 3 kHz) and repeat.



Test Data

Environmental Conditions

Temperature:	27 °C
Relative Humidity:	66%
ATM Pressure:	100.1 kPa

The testing was performed by Fan Yang on 2021-08-24.

EUT operation mode: Transmitting

Test Result: Compliant. Please refer to the Appendix Wi-Fi.

APPENDIX Wi-Fi

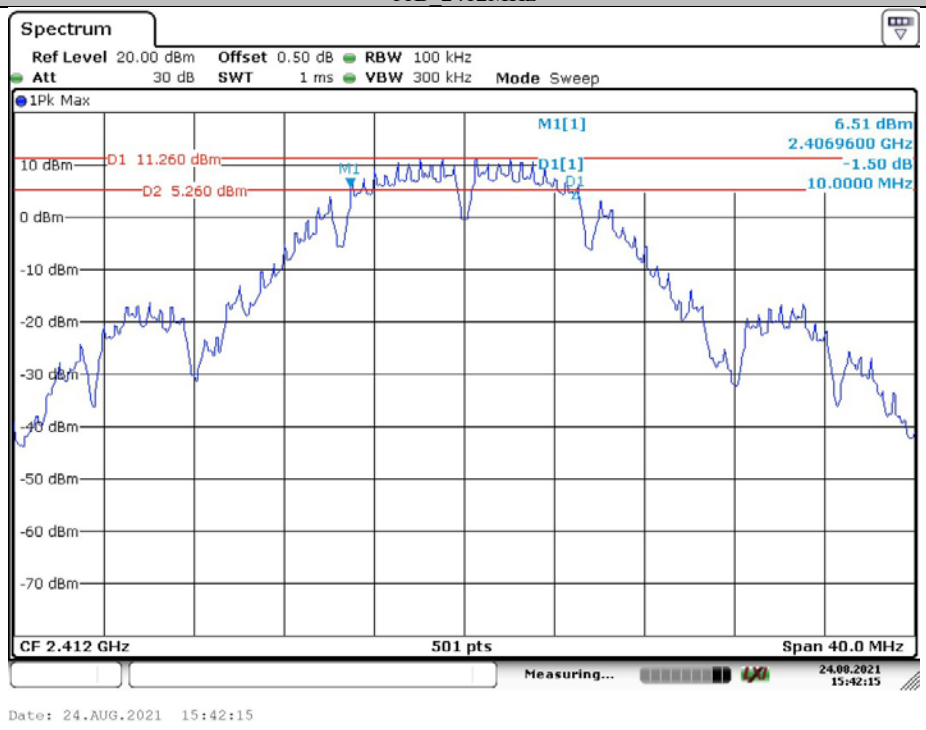
Appendix A: 6dB Emission Bandwidth

Test Result

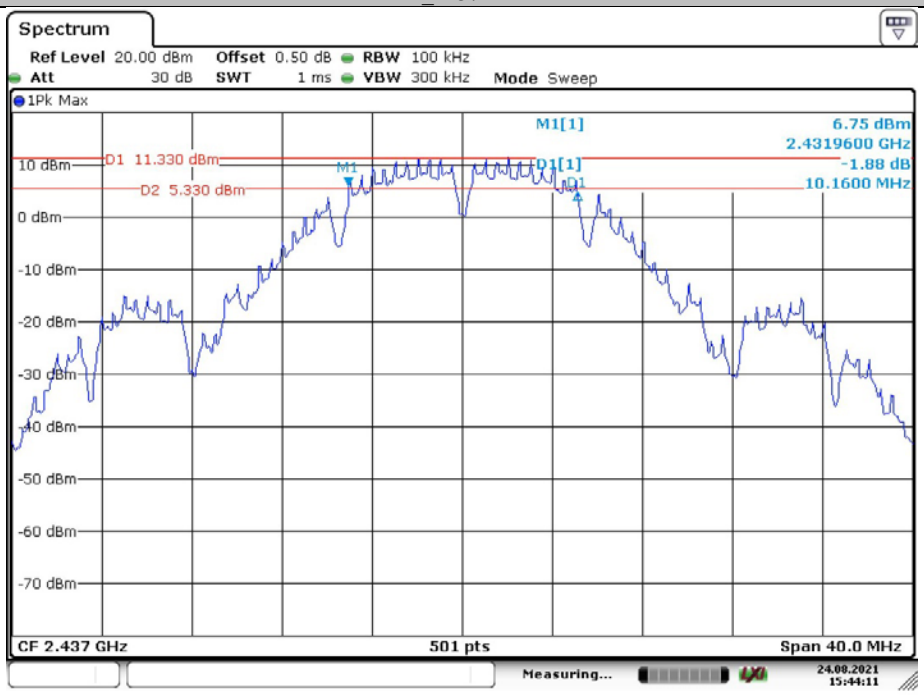
TestMode	Channel [MHz]	DTS BW [MHz]	Limit[MHz]	Verdict
11B	2412	10.000	0.5	PASS
	2437	10.160	0.5	PASS
	2462	10.000	0.5	PASS
11G	2412	16.400	0.5	PASS
	2437	16.400	0.5	PASS
	2462	16.400	0.5	PASS
11N20SISO	2412	16.720	0.5	PASS
	2437	16.320	0.5	PASS
	2462	16.640	0.5	PASS

Test Graphs

11B_2412MHz

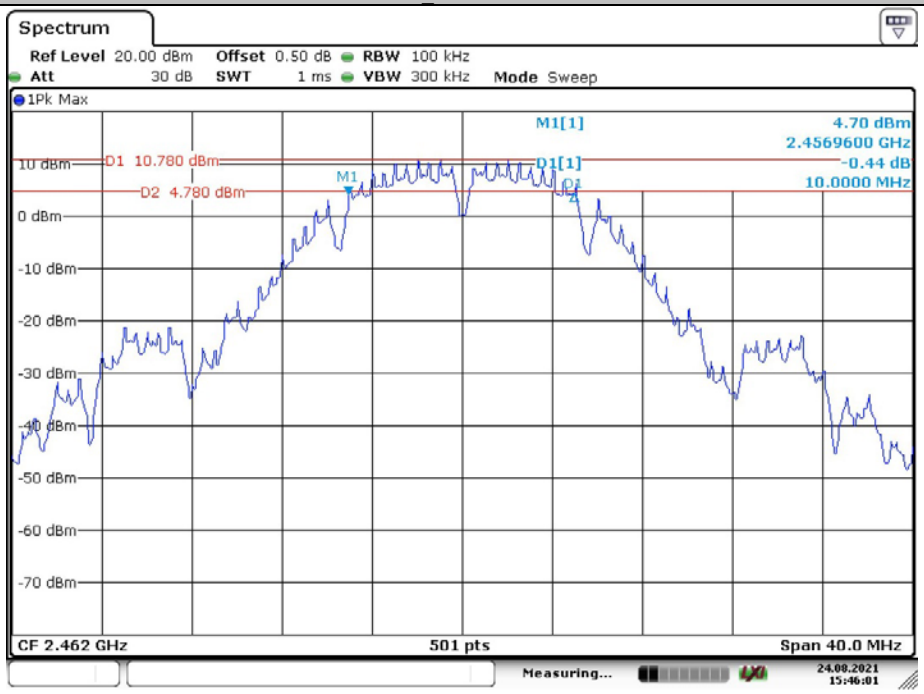


11B_2437MHz



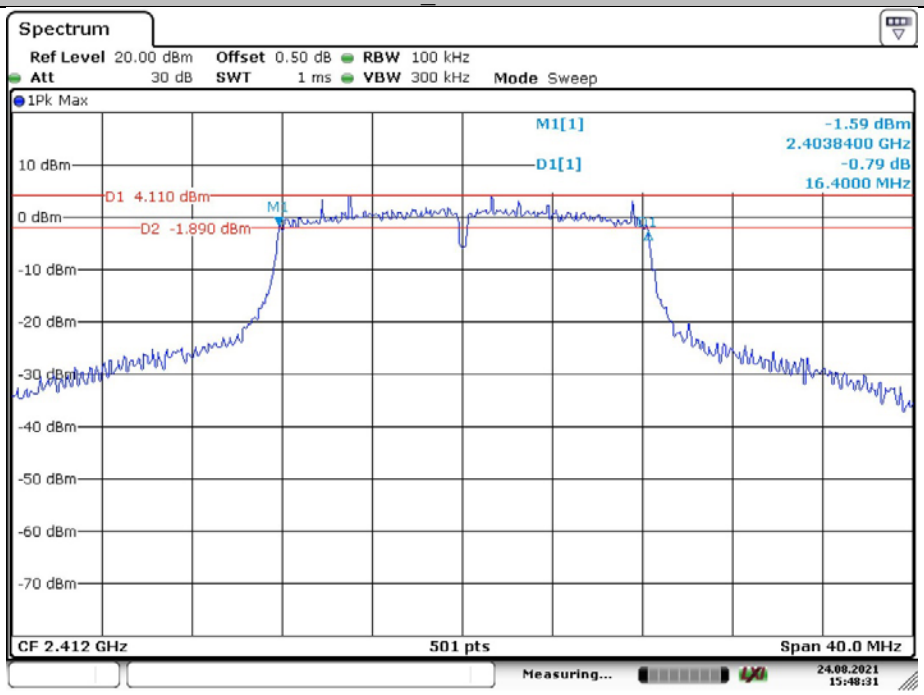
Date: 24.AUG.2021 15:44:11

11B_2462MHz



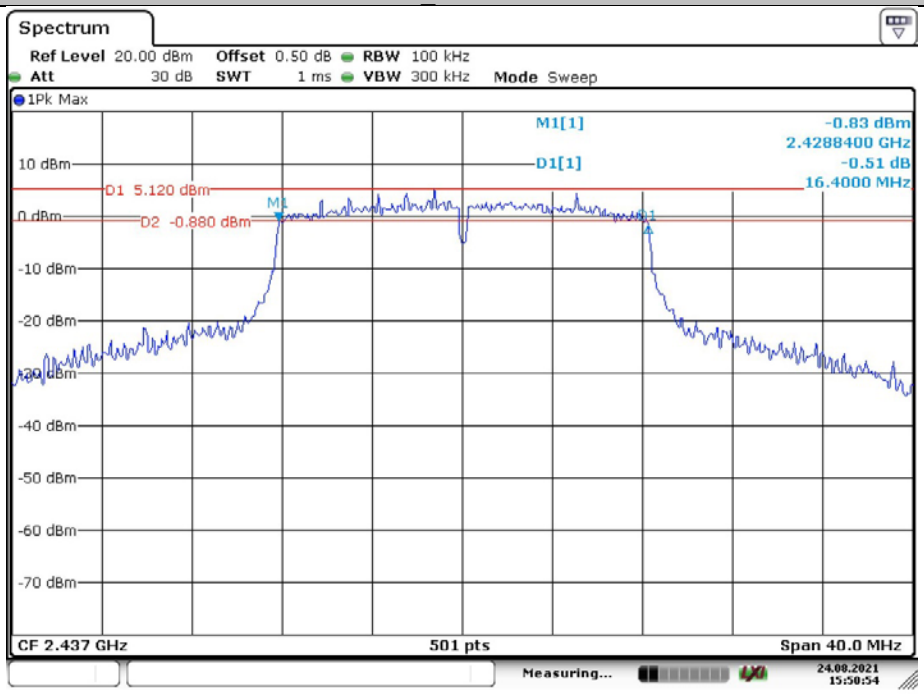
Date: 24.AUG.2021 15:46:02

11G_2412MHz



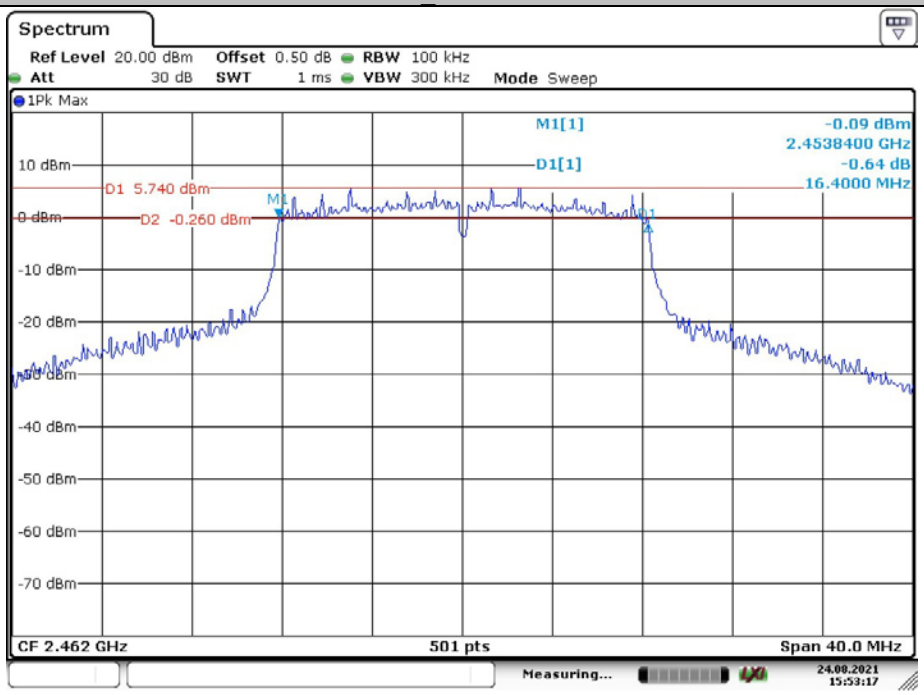
Date: 24.AUG.2021 15:48:31

11G_2437MHz



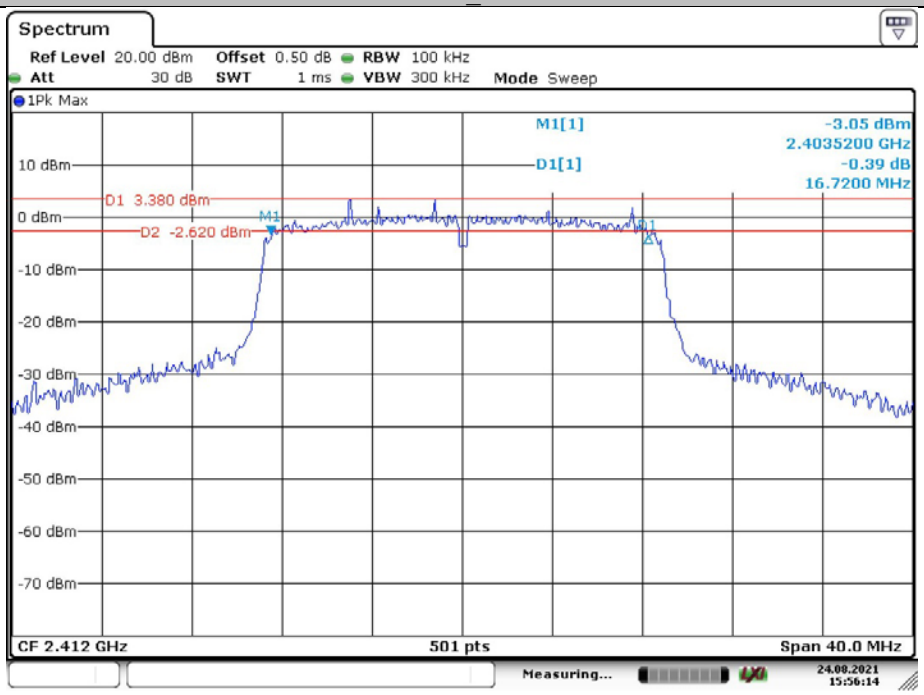
Date: 24.AUG.2021 15:50:55

11G_2462MHz



Date: 24.AUG.2021 15:53:18

11N20SISO_2412MHz



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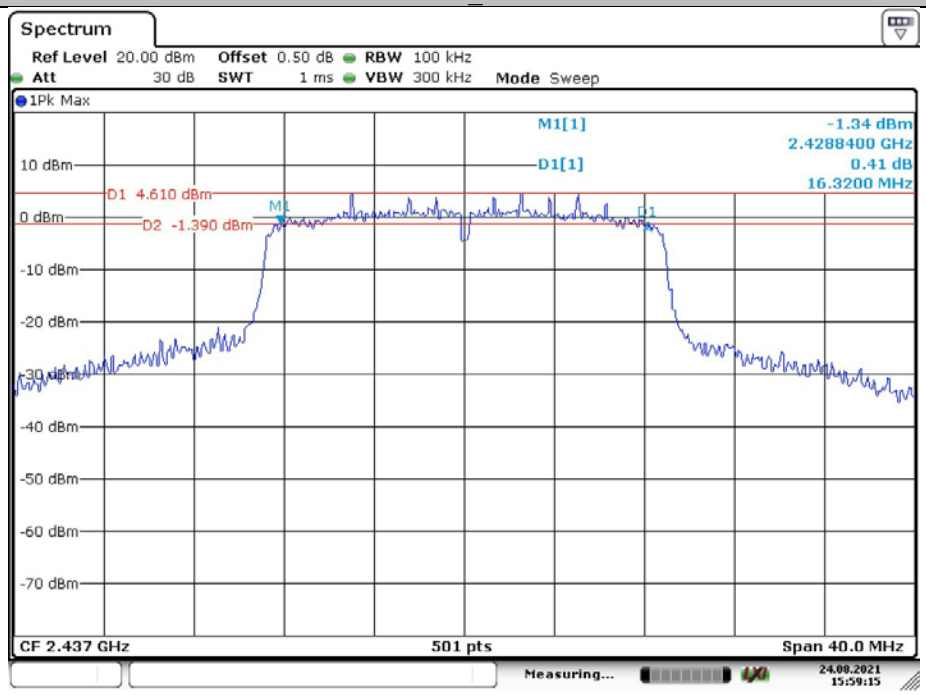
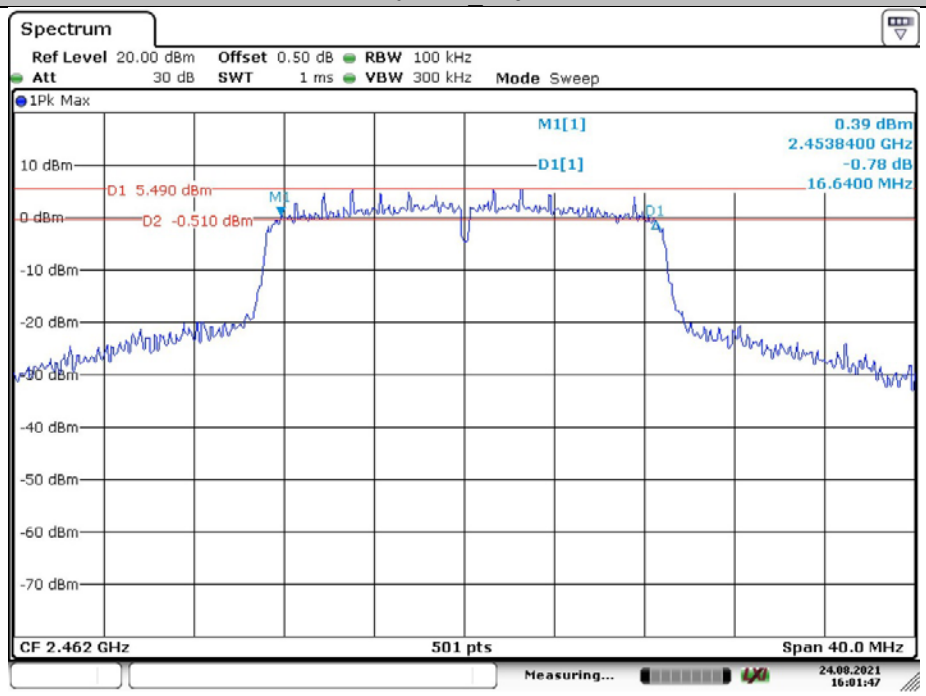
11N20SISO_2437MHz



Date: 24.AUG.2021 15:59:16

11N20SISO_2462MHz



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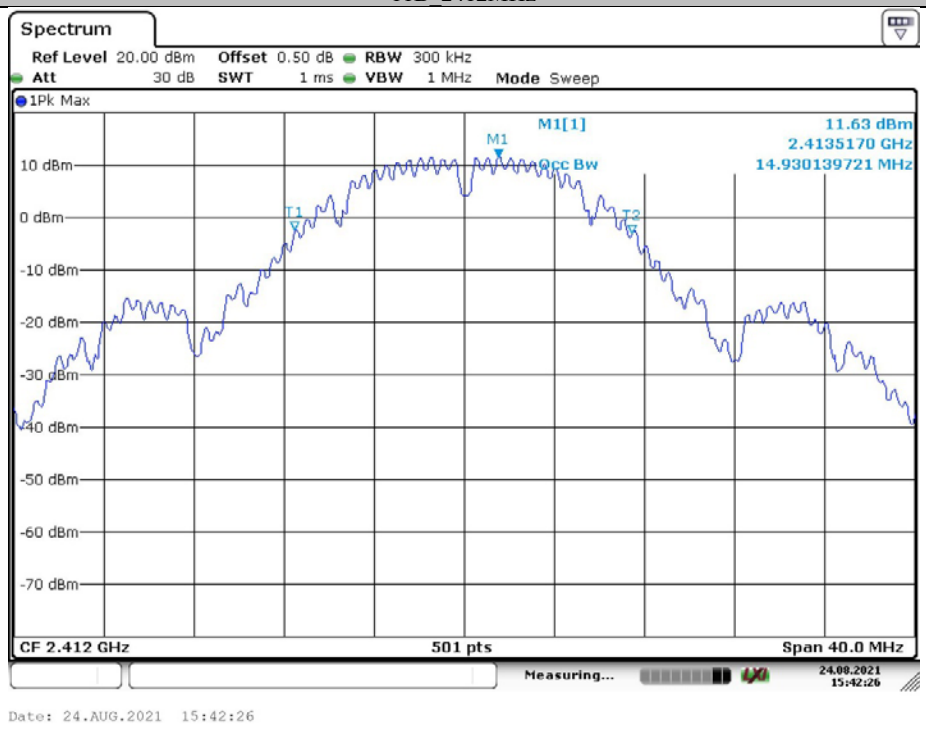
Appendix B: Occupied Channel Bandwidth

Test Result

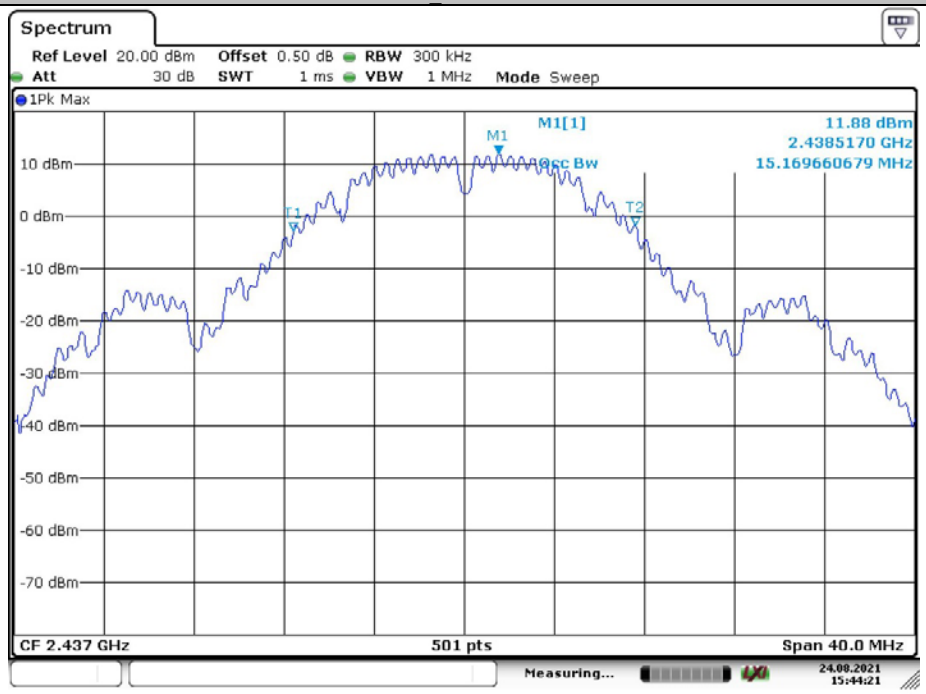
TestMode	Channel[MHz]	OCB [MHz]	Limit[MHz]	Verdict
11B	2412	14.930	---	PASS
	2437	15.170	---	PASS
	2462	14.212	---	PASS
11G	2412	16.846	---	PASS
	2437	17.086	---	PASS
	2462	17.086	---	PASS
11N20SISO	2412	17.565	---	PASS
	2437	17.725	---	PASS
	2462	17.884	---	PASS

Test Graphs

11B_2412MHz



11B_2437MHz



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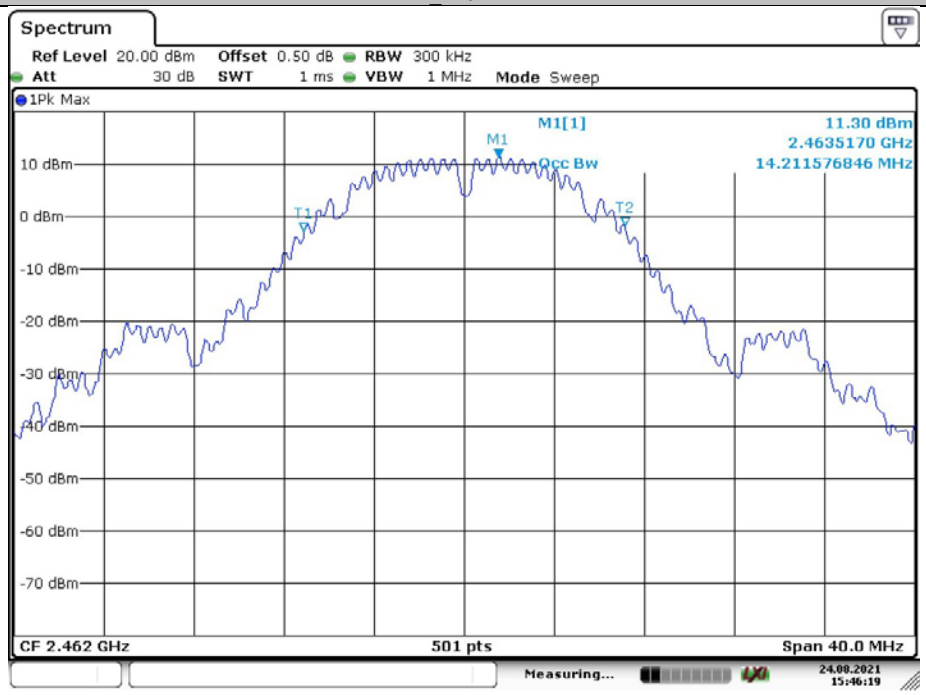
11B_2462MHz



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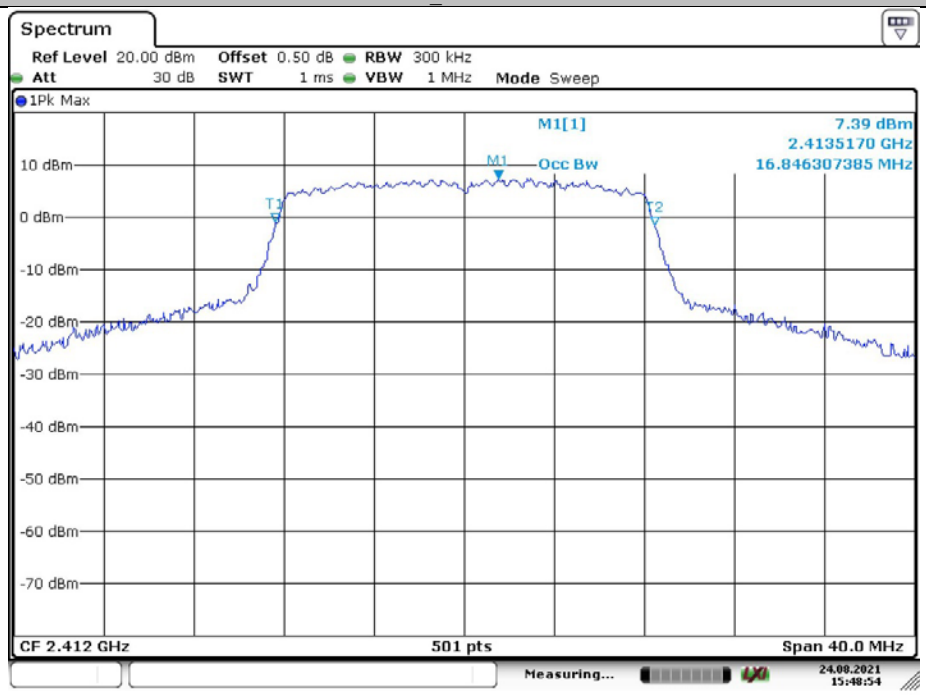
11G_2412MHz

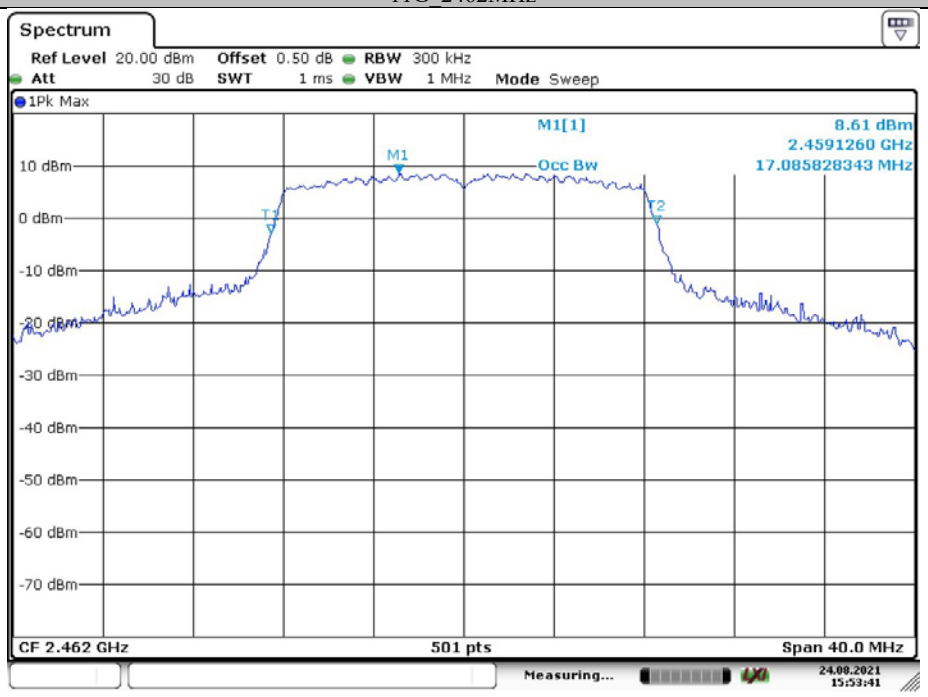


Date: 24.AUG.2021 15:48:54

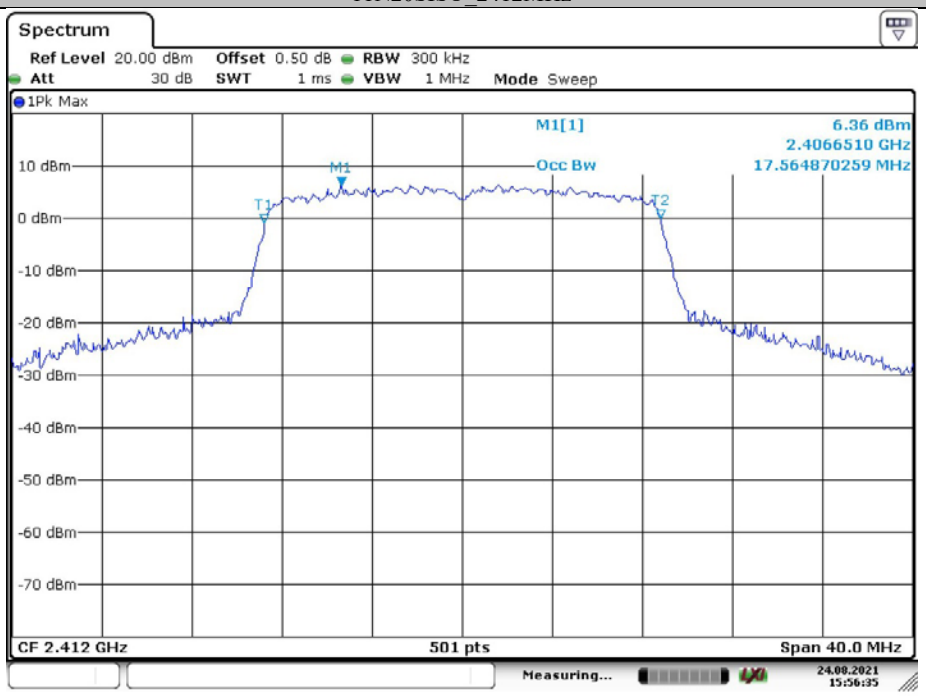
11G_2437MHz

Date: 24.AUG.2021 15:51:24

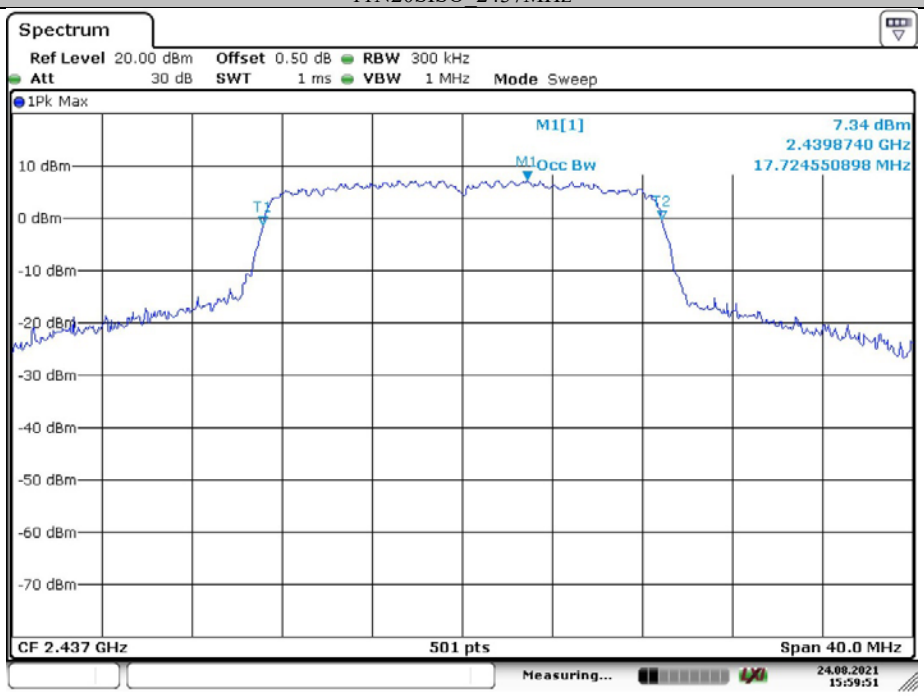
11G_2462MHz



11N20SISO_2412MHz

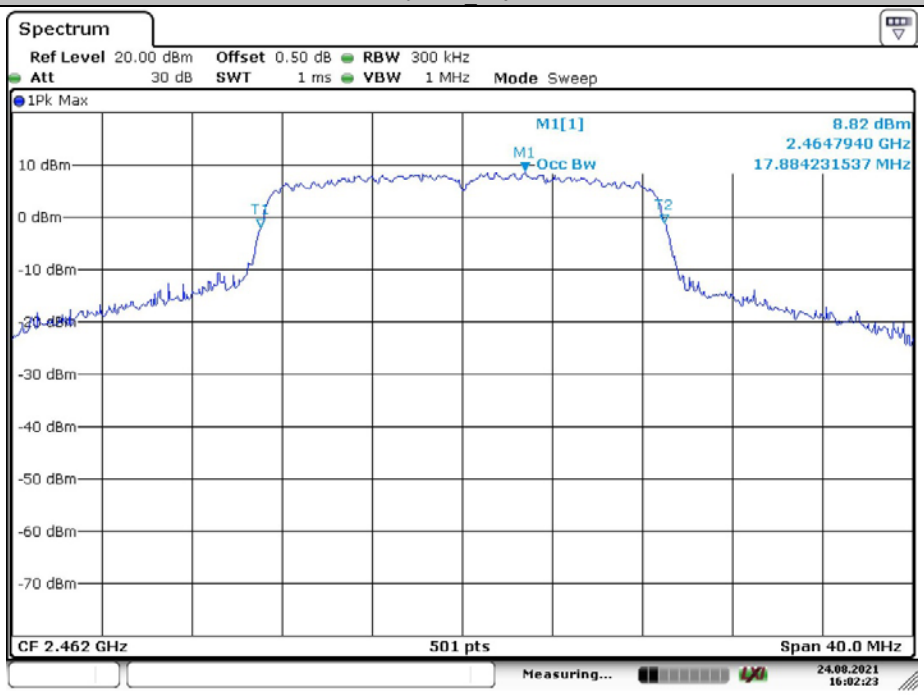


11N20SISO_2437MHz



Date: 24.AUG.2021 15:59:51

11N20SISO_2462MHz



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Appendix C: Maximum conducted output power

Test Result

TestMode	Channel [MHz]	Conducted Peak Power Result [dBm]	Limit [dBm]	Verdict
11B	2412	22.48	<=30	PASS
	2437	22.64	<=30	PASS
	2462	22.42	<=30	PASS
11G	2412	22.11	<=30	PASS
	2437	22.58	<=30	PASS
	2462	22.86	<=30	PASS
11N20SISO	2412	22.55	<=30	PASS
	2437	22.4	<=30	PASS
	2462	22.63	<=30	PASS

Note: The antenna gain is 2.0dBi, so the EIRP meet the RSS-247 Requirement.

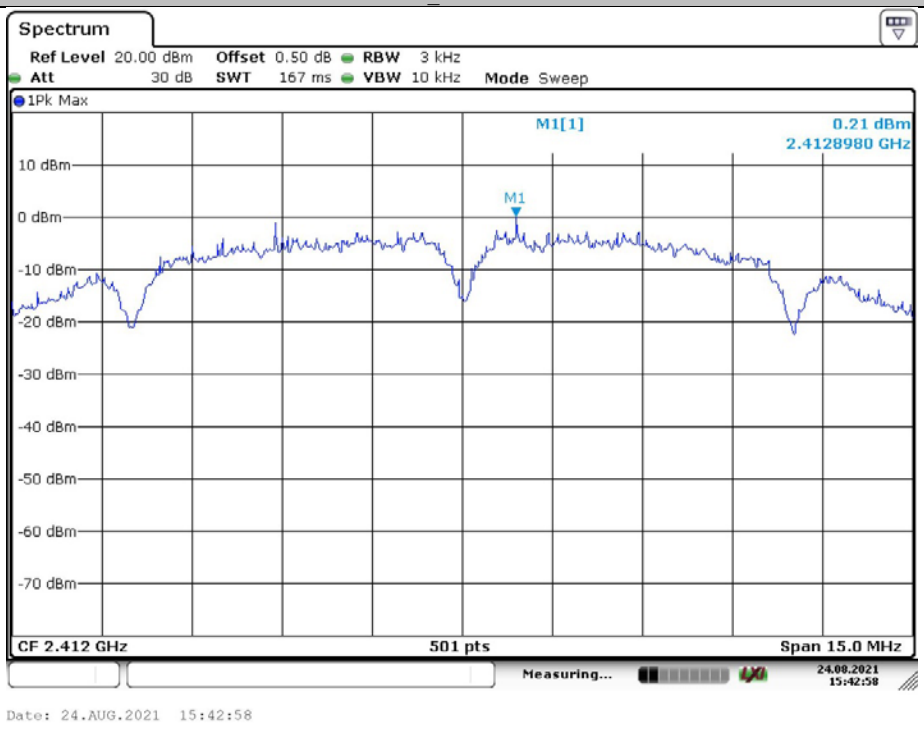
Appendix D: Power spectral density

Test Result

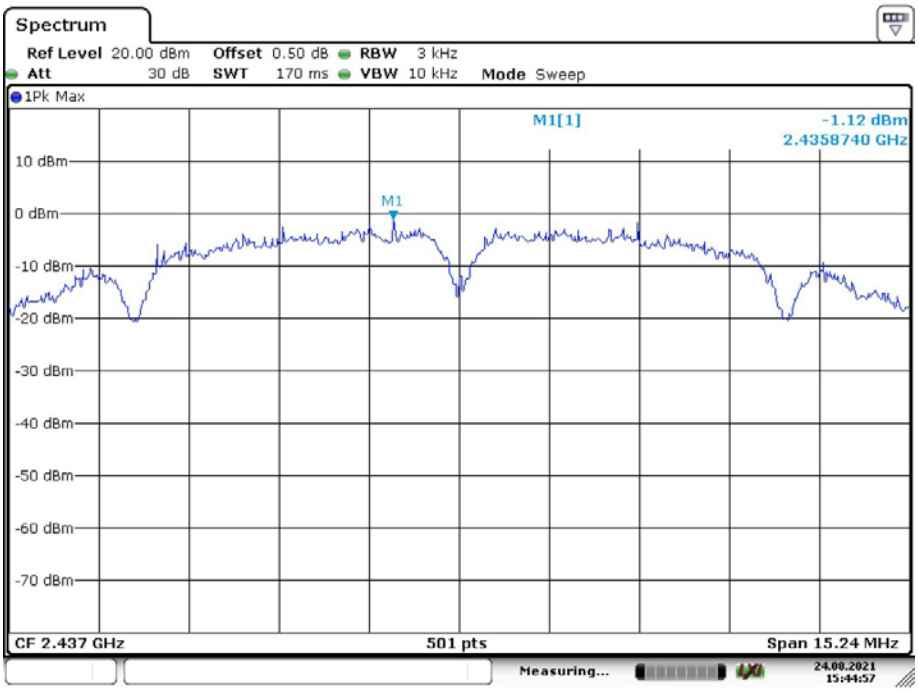
TestMode	Channel[MHz]	Result[dBm/3kHz]	Limit[dBm/3kHz]	Verdict
11B	2412	0.21	<=8	PASS
	2437	-1.12	<=8	PASS
	2462	-0.70	<=8	PASS
11G	2412	-8.88	<=8	PASS
	2437	-7.77	<=8	PASS
	2462	-7.26	<=8	PASS
11N20SISO	2412	-9.14	<=8	PASS
	2437	-9.12	<=8	PASS
	2462	-7.97	<=8	PASS

Test Graphs

11B_2412MHz

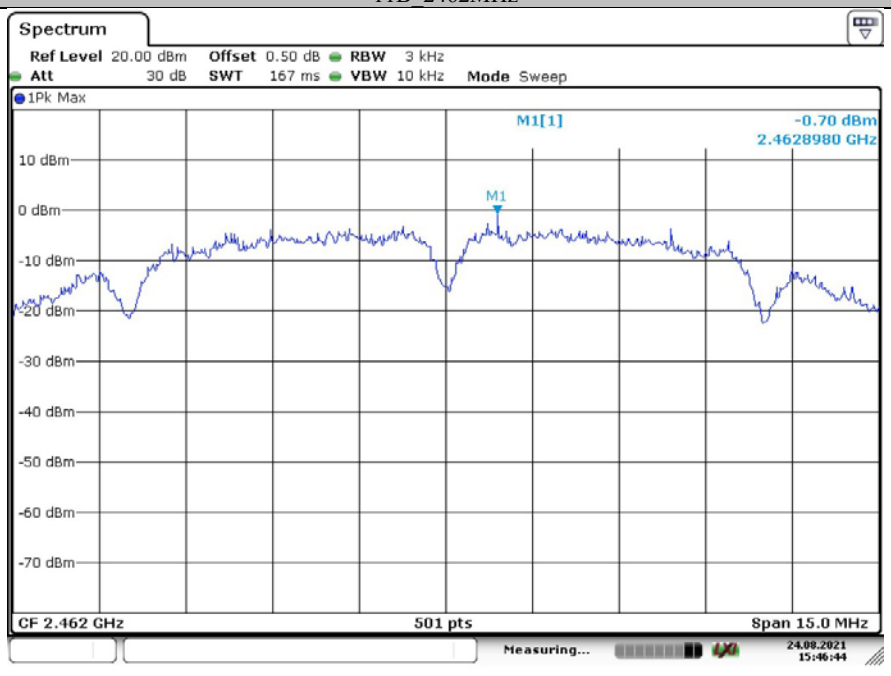


11B_2437MHz



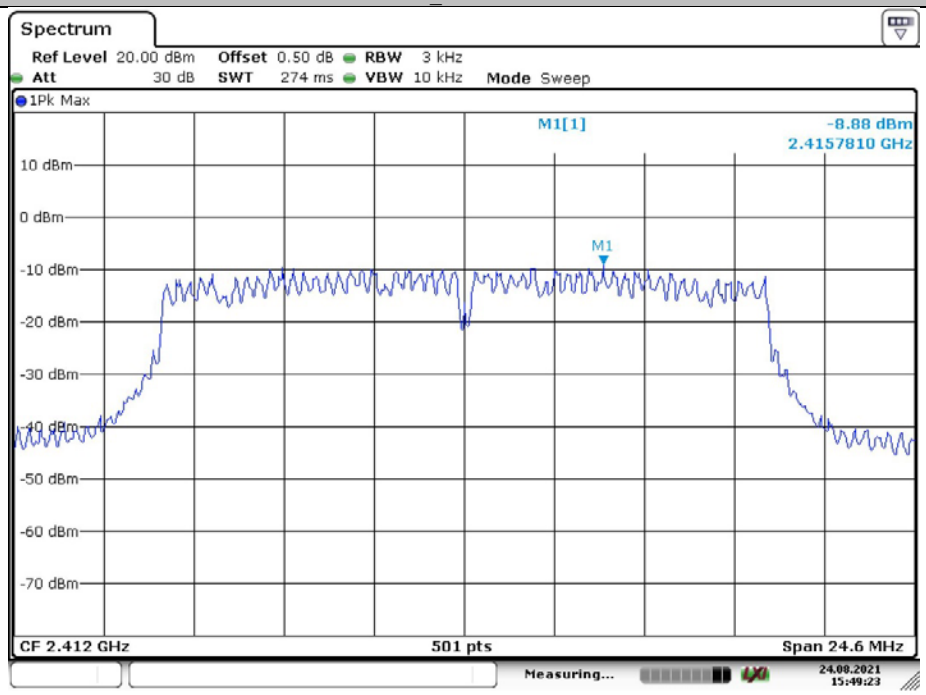
Date: 24.AUG.2021 15:44:57

11B_2462MHz



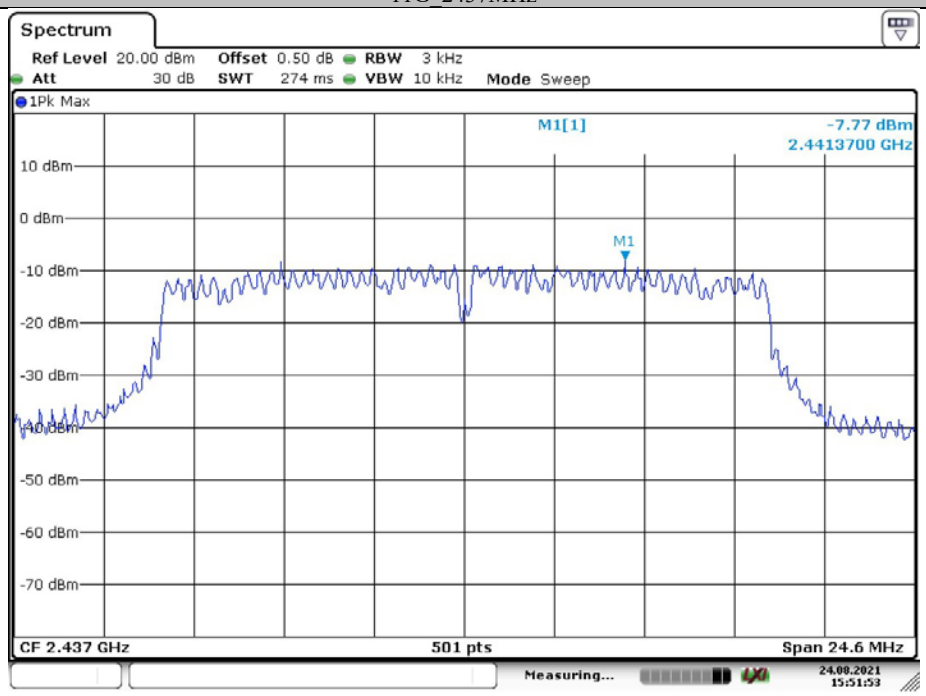
Date: 24.AUG.2021 15:46:44

11G_2412MHz



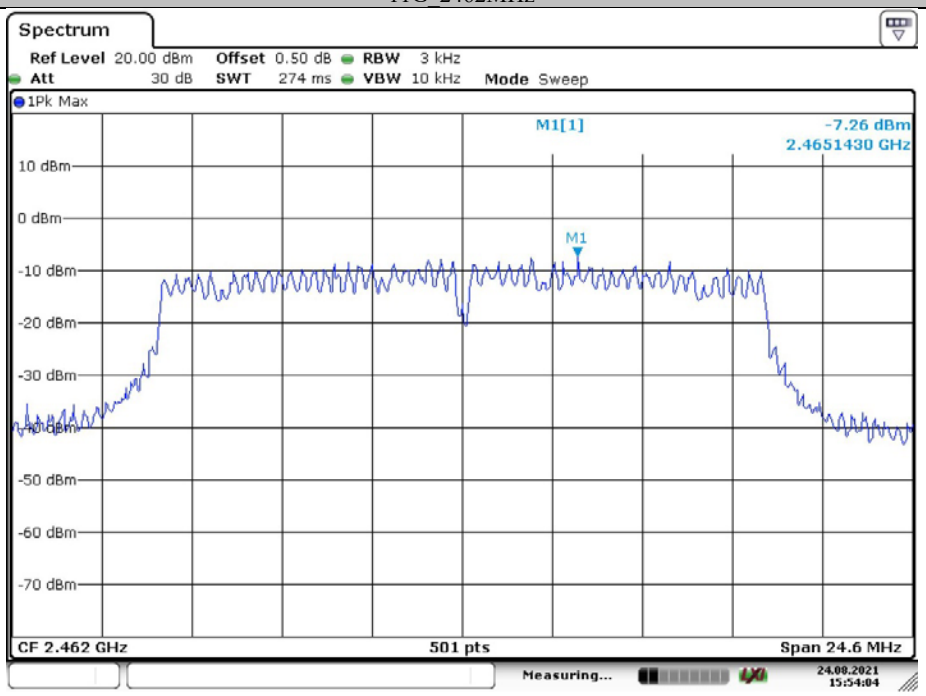
Date: 24.AUG.2021 15:49:23

11G_2437MHz



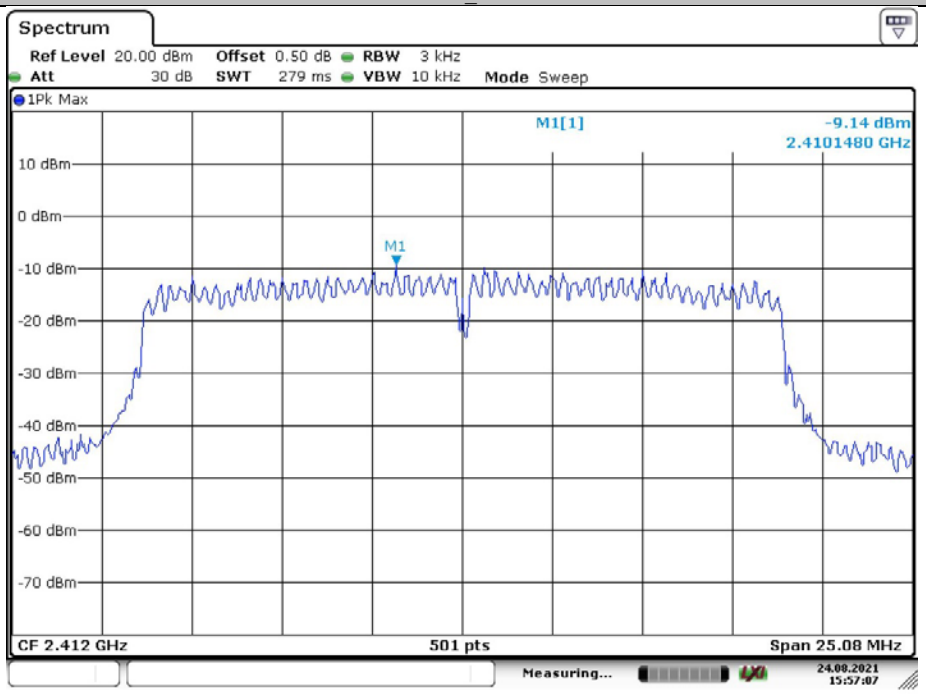
Date: 24.AUG.2021 15:51:53

11G_2462MHz



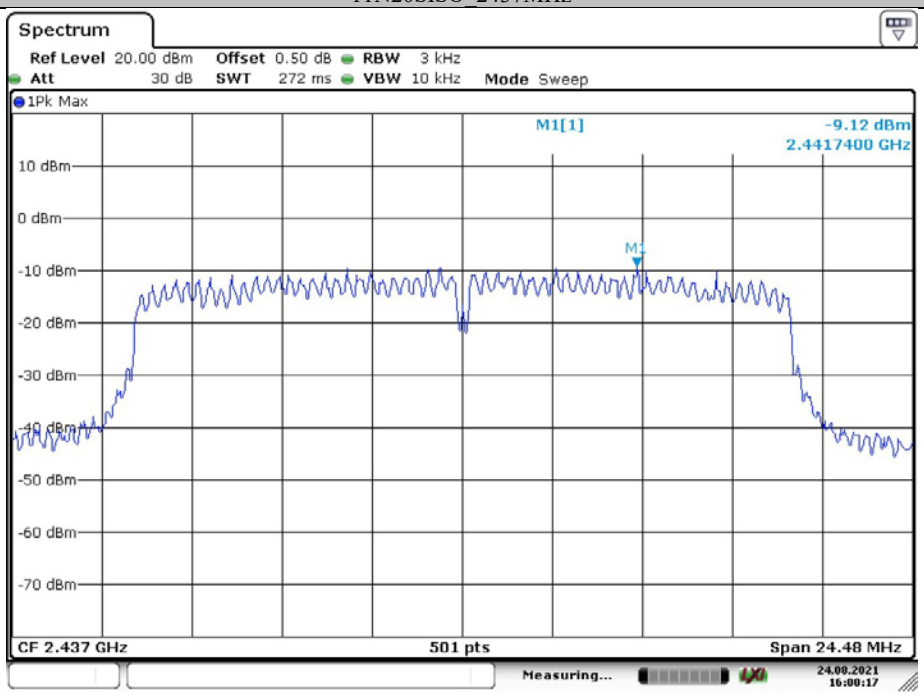
Date: 24.AUG.2021 15:54:04

11N20SISO_2412MHz



Date: 24.AUG.2021 15:57:07

11N20SISO_2437MHz



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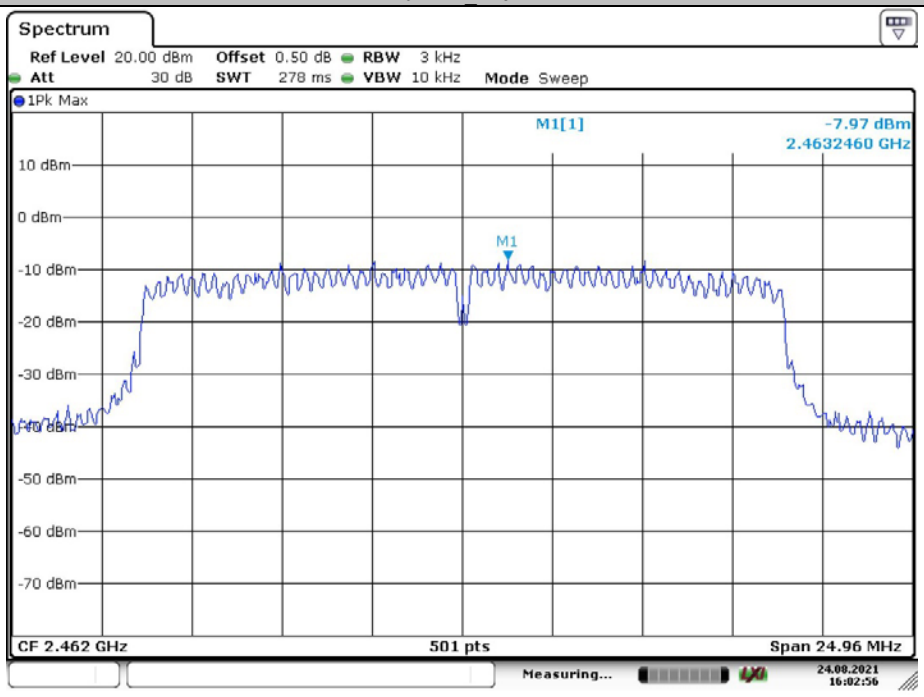
11N20SISO_2462MHz



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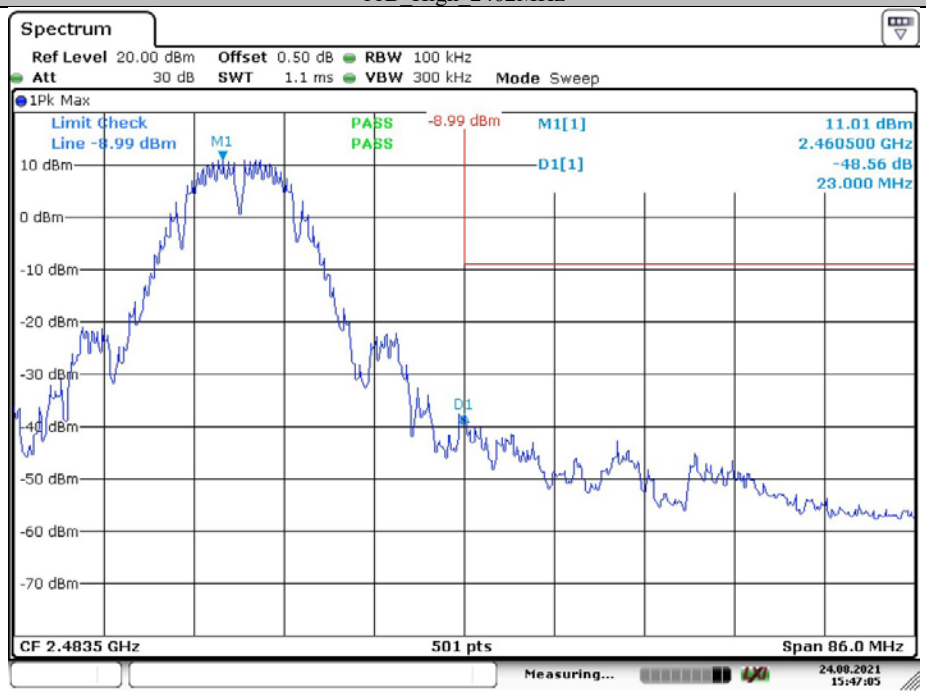
Appendix E: Band edge measurements

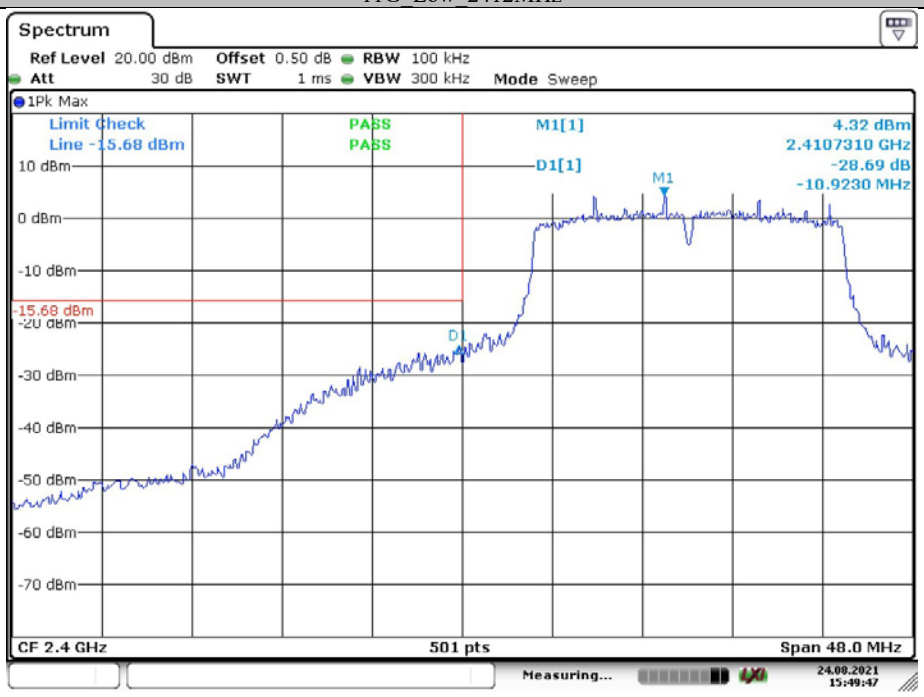
Test Graphs

11B_Low_2412MHz

11B_High_2462MHz



11G_Low_2412MHz



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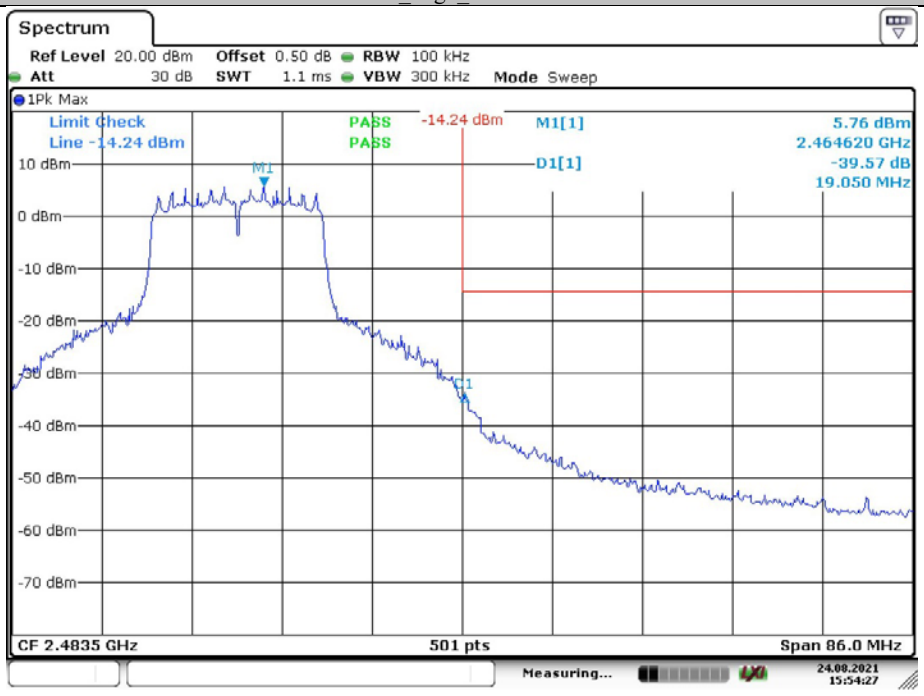
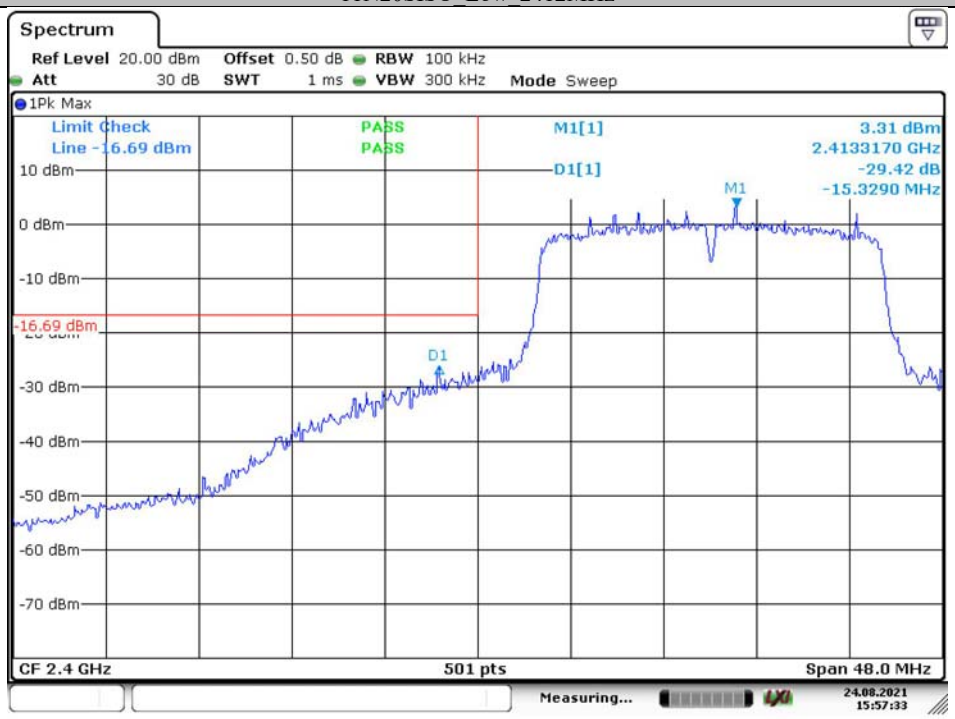
11G_High_2462MHz



Date: 24.AUG.2021 15:54:27

11N20SISO_Low_2412MHz



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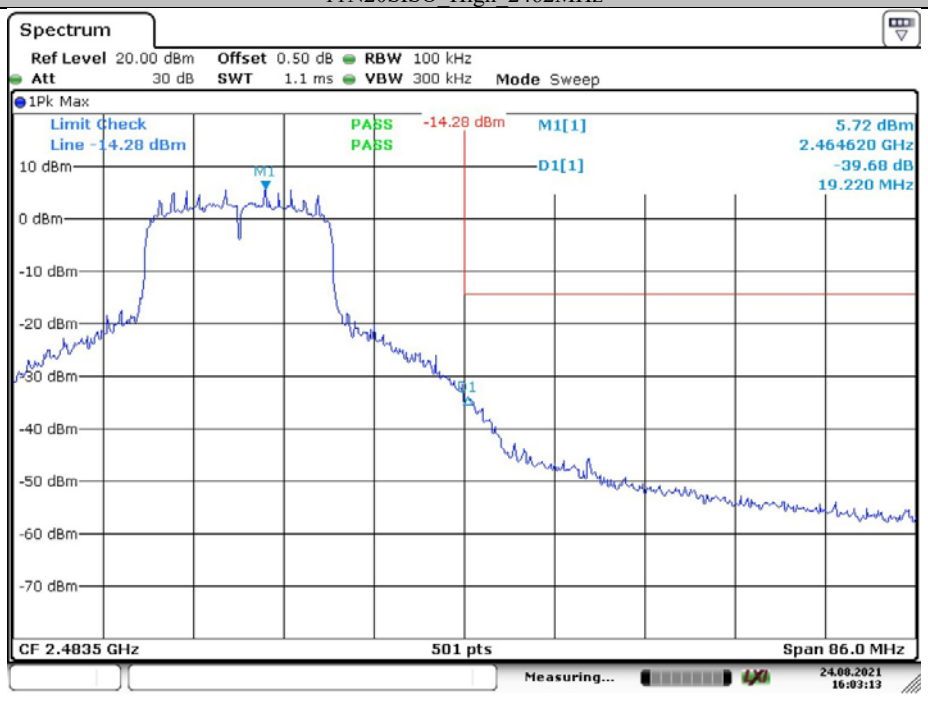
11N20SISO_High_2462MHz



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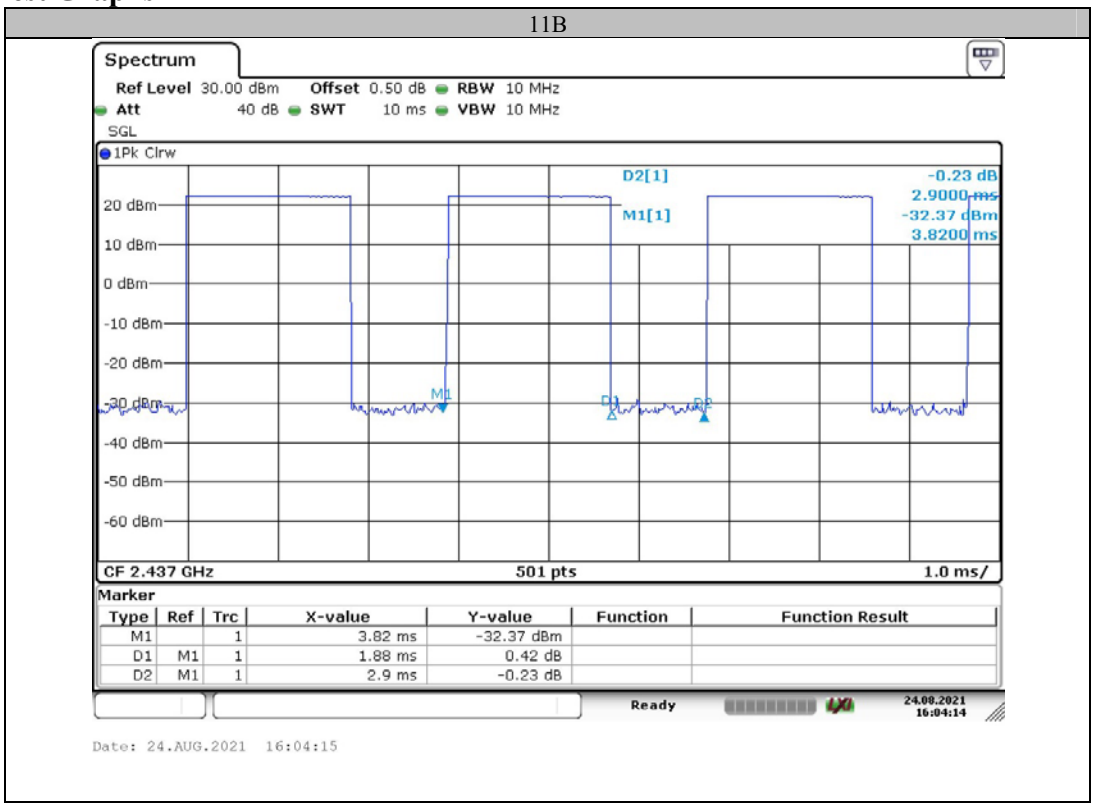
Appendix F: Duty Cycle

Test Result

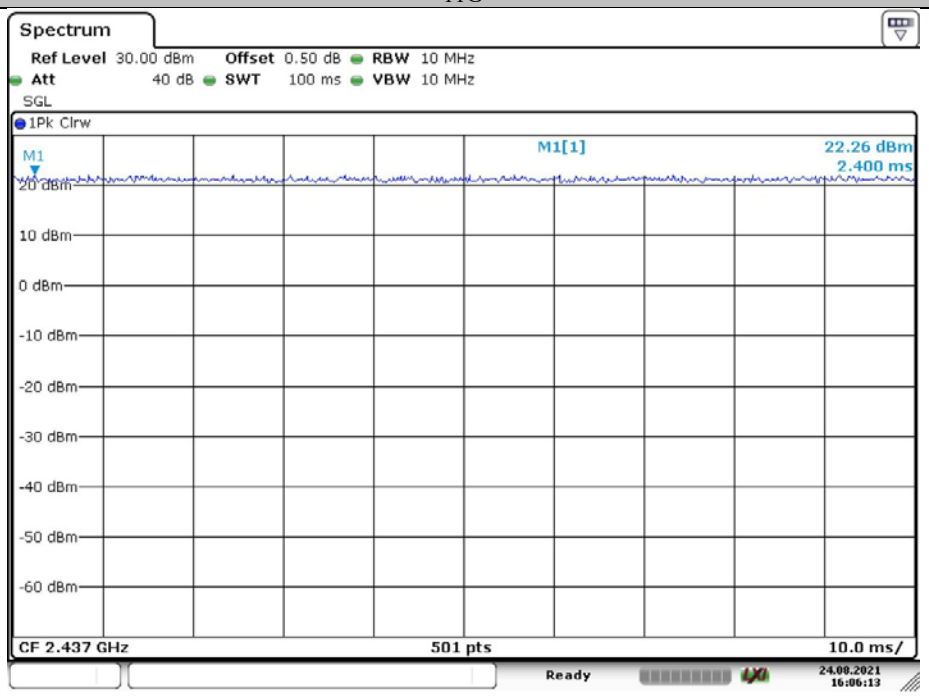
TestMode	Channel [MHz]	Transmission Duration [ms]	Transmission Period [ms]	Duty Cycle [%]
11B	2437	1.88	2.90	64.83
11G	2437	100	100	100
11N20SISO	2437	100	100	100

Test Graphs

11B



11G



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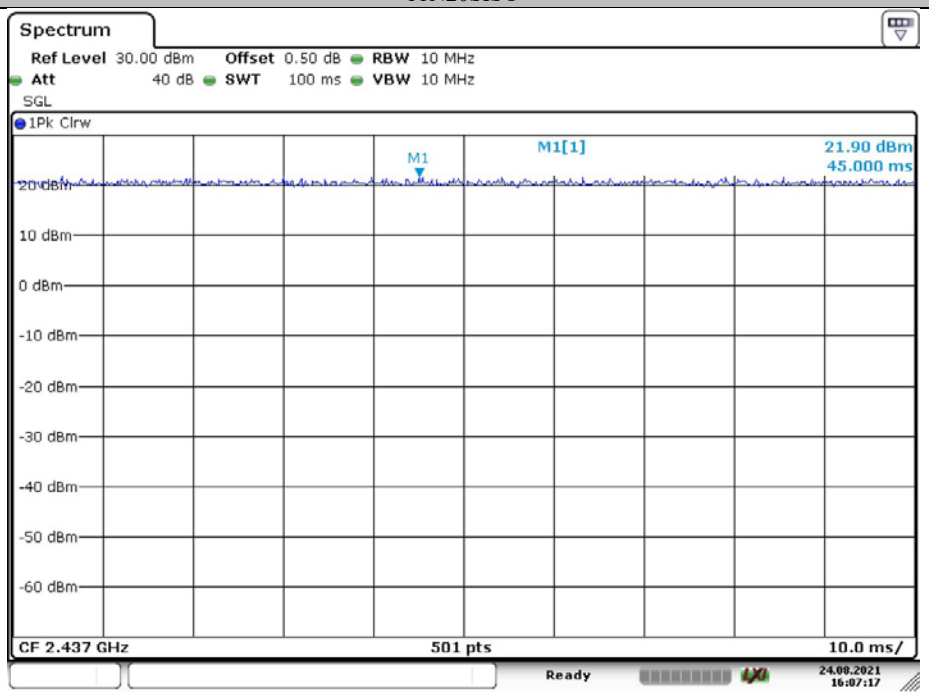
11N20SISO



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******* END OF REPORT *******